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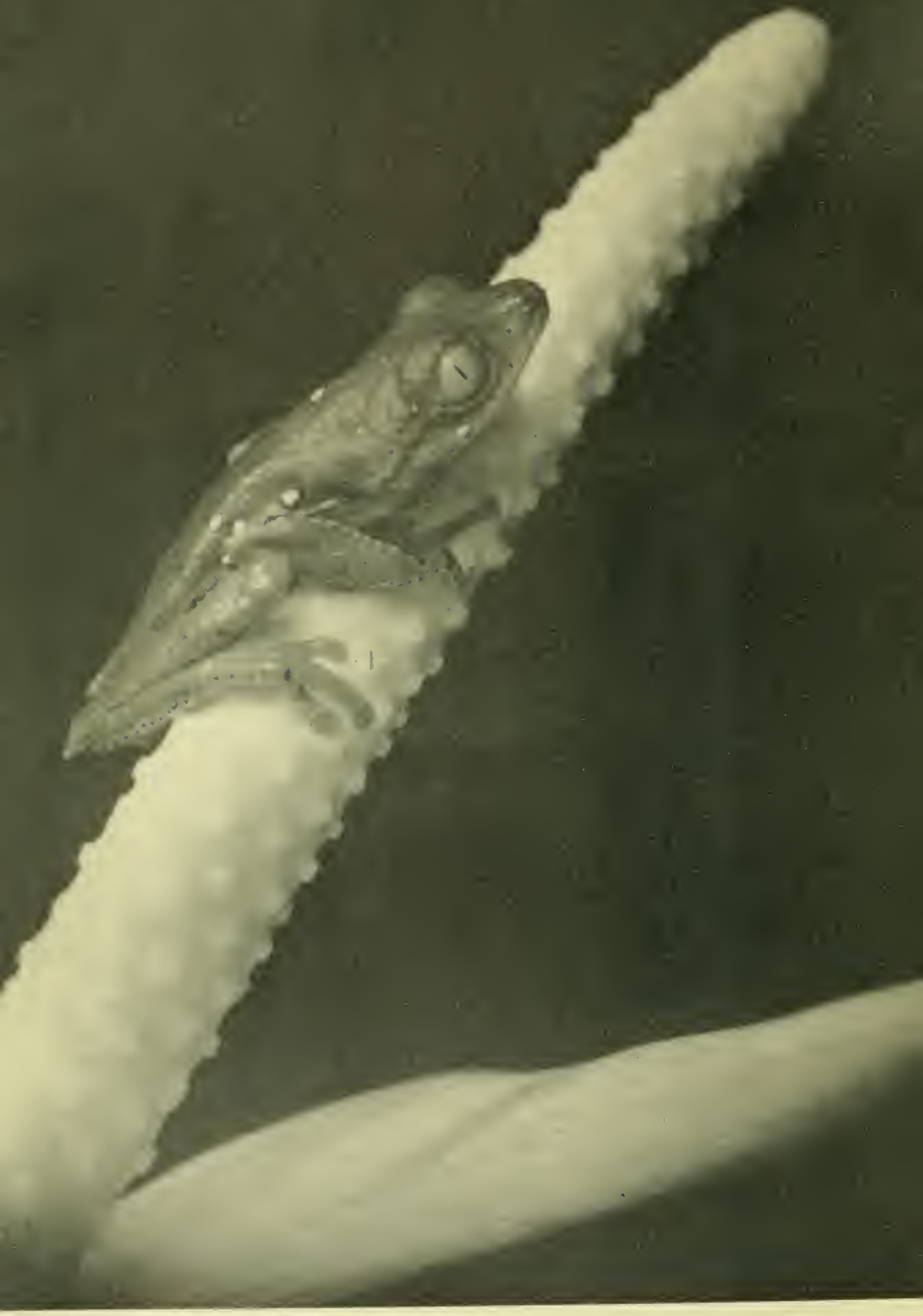

Phyllomedusa appendiculata from Teresópolis, Organ Mountains National Park, Rio de Janeiro, December 1944. Photographed by Dr. Gualter Lutz.

Circ.

United States National Museum
Bulletin 206

FROGS OF SOUTHEASTERN BRAZIL

By DORIS M. COCHRAN, ASSOCIATE CURATOR
Division of Reptiles and Amphibians
United States National Museum

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The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

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The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

The present work forms No. 206 of the *Bulletin* series.

Remington Kellogg,
Director, United States National Museum.

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To the memory of Dr. Adolpho Lutz (1855–1940), whose pioneering work in Brazilian biology and medicine has left an enduring mark on tropical research.

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Introduction

The herpetology of tropical America has been a continuing subject of research by the staff of the Division of Reptiles and Amphibians of the United States National Museum for over half a century. The opportunity to visit Brazil came to me in 1935 through an invitation from the late Dr. Adolpho Lutz, who, during my five months' stay, showed me examples of many species of frogs and made numerous comments upon them.

Together, Dr. Lutz and I visited most of his type localities in the Districto Federal and made excursions to Nova Friburgo and Petrópolis. With his collector Joaquim Venancio, I visited Bello Horizonte, Lassance, Pirapora, and Ouro Prêto in Minas Gerais; and the city of São Paulo, the biological reserve of Alto da Serra, and Santos in São Paulo. To my own collections of over 1,500 specimens, mostly frogs, for the United States National Museum, Dr. Lutz generously added a donation of over 1,100 specimens from his own collections, including cotypes or topotypes of most of the species named by him.

I obtained fresh specimens of all the species described by Girard in 1853 from material collected in Rio de Janeiro by the U. S. Exploring Expedition on its round-the-world voyage begun in 1837. These I have compared with such of Girard's types as are still extant in the National Museum and have figured them in the following pages. In the several European museums having Brazilian collections I have photographed many historic type specimens, and have measured and compared them, giving particular attention to characters often neglected in the early diagnoses.

Other material for comparison was borrowed from various institutions, to all of which I am deeply grateful. Chief among these are the Musée Royale d'Histoire Naturelle de Belgique, the British Museum (Natural History), the Natur-Museum Senckenberg, the Departamento de Zoologia, Secretaria da Agricultura, São Paulo, the Museum of Zoology of the University of Michigan, the Chicago Natural History Museum, and the Museum of Comparative Zoology.

To Dr. Adolpho Lutz for the invitation that took me to Brazil and for his kind gift of study material and field notes, as well as to Dr. Leonhard Stejneger for his helpful advice at the beginning of these studies, I am most grateful. I regret that neither lived to see the completion of this paper. To Bertha Lutz, Karl P. Schmidt, Lorenz

Müller, H. W. Parker, E. R. Dunn, and Helen T. Gaige, for furnishing useful notes and comparing numerous specimens, and to the many others who helped in various ways, go my warmest thanks.

Characters are described in the same order for each species, thus making it possible to compare species readily. Critical measurements of the most stable physical features were taken as follows:

HEAD AND BODY (total length): The straight distance from snout tip to end of body, measured by dividers or calipers.

HEAD LENGTH: The distance from tip of snout to posterior border of tympanum, measured directly with dividers. In frogs having no visible tympanum the head length was taken from tip of snout to posterior end of maxilla.

HEAD WIDTH: The greatest width of the head, usually from a point between eye and tympanum to a corresponding point on the opposite side of head, measured directly with dividers. Some species, such as *Bufo typhonius*, have bony processes at the angles of the jaw; these are not included in the measurement of head width.

FEMUR: The femora having been placed at right angles to the body axis, the distance between the centers of the knees is taken with dividers. One-half this measurement is taken as the length of a single femur. This method gives greater accuracy than the customary anus-to-knee measurement.

TIBIA: The distance from center of knee to center of heel.

FOOT: The distance from tip of fourth toe to distal margin of inner metatarsal tubercle. As the distance from tubercle to heel is not included, this measurement is short of the actual foot length.

HAND: The distance from tip of third finger to base of first finger. In some instances the length of the fore leg (distance from tip of third finger to axilla) and hind leg (distance from tip of fourth toe to groin) is given.

The following abbreviations were used in identifying the specimens examined:

AMNH	American Museum of Natural History, New York City
ANSP	Academy of Natural Sciences of Philadelphia
BM	British Museum (Natural History), London
CAS	California Academy of Sciences, San Francisco
CM	Carnegie Museum, Pittsburgh
CMNH	Chicago Natural History Museum, Chicago
DZSP	Departmento de Zoologia, Secretaria da Agricultura, São Paulo
FMNH	Field Musuem of Natural History (now Chicago Natural History Museum)
IB	Instituto Butantan, São Paulo
IOC	Instituto Oswaldo Cruz, Rio de Janeiro

KZAEM	Koenglisches Zoologisches und Anthropologisch-Ethnographisches Museum, Dresden
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge
MHNP	Muséum National d'Histoire Naturelle, Paris
MN	Museu Nacional, Rio de Janeiro
MP	Museu Paulista (now Departamento de Zoologia, Secretaria da Agricultura, São Paulo)
MRHN	Musée Royale d'Histoire Naturelle de Belgique, Brussels
MZUM	Museum of Zoology, University of Michigan, Ann Arbor
NHMH	Naturhistorisches Museum [Zoologisches Staatsinstitut und zoologisches Museum], Hamburg
NHMW	Naturhistorisches Museums, Vienna
NMS	Natur-Museum Senckenberg [Senckenbergische Naturforschende Gesellschaft], Frankfort-am-Main
NYZS	New York Zoological Society, New York City
USNM	United States National Museum
UZMK	Kobenhavns Universitet, Zoologisk Museum, Copenhagen
ZMB	Zoologisches Museum, Berlin
ZSBS	Zoologische Sammlung des Bayerischen Staats [Zoologisches Staatssammlung], Munich

Most of the colors named in the descriptions were compared with those in the first edition of Ridgway's, "A Nomenclature of Colors for Naturalists, and Compendium of Useful Knowledge for Ornithologists," 1886.

The pen-and-ink illustrations for the text figures and most of the profiles on the plates were made by me.

The new species named by Dr. Adolpho Lutz between the years 1924 and 1929 were mostly without specified types. However, a figure of each new species was painted under Dr. Lutz's direction, and he referred constantly to it while making the notes accompanying the published name. Whenever possible, I have designated as type the specimen represented in one of these colored figures, now in the possession of his daughter, Dr. Bertha Lutz. If I found no individual corresponding to a colored figure, I designated as cotypes all the specimens known to have been in his collections at the time his published specific name first appeared.

Where the number of specimens warranted, a graph comparing the statistical variation of critical measurements in each species with all in its group was prepared. These graphs, with an explanation of the method of preparation, are found on pages 373–385.

Every physical character found in frogs varies to some extent, and some characters vary much more than others. These facts have not been fully realized by some authors. For instance, the position and development of the vomerine teeth, used by Boulenger, Cope, and other herpetologists, are not constant in some species. Key characters must therefore be interpreted rather widely, with the realization that no key will suffice for the identification of every individual in a variable species.

The axillar wing, found in only a few species of frogs, is a membrane extending from the arm part way down the side, and is apparent only when the arm is placed at right angles to the body. This structure is especially well developed in frogs of the *Hyla marmorata* group.

Frogs of the family Centrolenidae from Brazil are reviewed in a paper by Taylor and Cochran (1953).

The present study includes frogs from southeastern Brazil—Minas Gerais, Rio de Janeiro, and São Paulo. The frogs of western Brazil—Paraná, Mato Grosso, and Goiás, are not included in this paper, and will be reported upon separately at a future date.

Some specimens not from southeastern Brazil have been included in these notes when they throw light on range or relationships of frogs from the region under consideration.

A great deal of observation needs to be done on the life histories of many species. A comparison of tadpoles of members of the *Hyla rubra* group should be made to see if there are some stable differences in the larvae to augment the very fluctuating characters of the adults. A new form of *Phyllomedusa* allied to *guttata* is indicated by the difference between the mouth parts of young from São Paulo and those of typical *guttata* from the State of Rio de Janeiro.

It must be understood that the following discussion cannot be considered complete or final for the frogs of even this relatively limited area. Several species, known as yet from only a few specimens, need further concentrated collecting and careful examination, while many more species new to science are certainly yet to be found and named. It is hoped, nevertheless, that some of the observations recorded here, as well as the indication of the more obvious gaps that occur in our knowledge, may stimulate further interest in Brazilian frogs.

Frogs of Southeastern Brazil

Class AMPHIBIA: Order SALIENTIA

The frogs of southeastern Brazil belong to two suborders of the order Salientia: the suborder Procoela, which has the centrum of the sacral vertebra concave anteriorly, as defined by Nicholls (1916, p. 87), contains five of the six families occurring in the region; and the suborder Diplasiocoela, which Nicholls defines as having the centrum of the sacral vertebra convex anteriorly. This suborder is represented by the family Microhylidae, a group rather easily recognized by reason of the narrow mouth, slender head, and heavy body.

Suborder PROCOELA

Key to families of Procoela of southeastern Brazil

a^1. Arciferal (right and left halves of pectoral girdle overlapping on median ventral line posteriorly and movable, one above the other).
  b^1. No intercalary cartilage between last two phalanges of fingers.
    c^1. An omosternum present; maxilla usually toothed; parotoid glands usually absent . . . . **Leptodactylidae** (p. 217)
    c^2. No omosternum present; maxillary usually toothless; parotoid glands present . . . . **Bufonidae** (p. 17)
  b^2. An intercalary cartilage present.
    c^1. Astragalus and calcaneum fused into a single bone **Centrolenidae** (p. 43)
    c^2. Astragalus and calcaneum not fused . . . . **Hylidae** (p. 44)
a^2. Firmisternal (right and left halves of pectoral girdle partly or completely fused on median line and immovable) . . . . . **Brachycephalidae** (p. 1)

Family BRACHYCEPHALIDAE

Key to genera of Brachycephalidae of southeastern Brazil

a^1. A pair of dermal scutes on upper surface of each digit tip, latter more or less dilated into adhesive disks; omosternum present, frequently bony.
  b^1. Toes webbed.
    c^1. Maxillary teeth present; a tarsal tubercle . . . . **Noblella** (p. 12)
    c^2. No maxillary teeth; no tarsal tubercle . . . . . . **Dendrobates** (p. 8)
  b^2. Toes not webbed . . . . **Phyllobates** (p. 14)
a^2. No digital scutes; no omosternum.
  b^1. Pectoral girdle completely fused; skin fairly smooth.

*c*¹. Digits normally developed; head squarish in front; feet rather swollen; dorsum usually black, variegated with bright yellow or red. **Atelopus** (p. 2)

*c*². Digits much reduced; a large bony plate on back; body bright yellow. **Brachycephalus** (p. 4)

*b*². Pectoral girdle partly fused; skin rough. . . . **Dendrophryniscus** (p. 10)

The name *Hylaplesia* Boie, used by A. Lutz (1926a, p. 8) for *Dendrobates flavopictus*, was relegated to the synonymy of *Hyla* (genotype, *Hyla punctata*) by Stejneger (Copeia, 1937, No. 2, p. 139).

Genus *Atelopus* Duméril and Bibron

1841. *Atelopus* Duméril and Bibron, p. 660. (Genotype *Atelopus flavescens* Duméril and Bibron.)

Generic diagnosis.—Pupil horizontal. Tongue elliptical, entire, free behind. Palate smooth. No tympanic disk. Fingers free or webbed at the base; toes more or less webbed, the tips not dilated into regular disks. Outer metatarsals united. Coracoids and precoracoids more or less divergent, connected by the epicoracoid cartilage; no omosternum; sternum cartilaginous. Diapophyses of sacral vertebra moderately dilated. Terminal phalanges simple.

Atelopus moreirae moreirae Miranda-Ribeiro

Plate 1, Figures a–c

1920. *Atelopus moreirae* Miranda-Ribeiro, 1920e, p. 307, pl. (type locality, Itatiaia, Rio de Janeiro); 1926, pp. 174, 224.

1938. *Dendrophryniscus moreirae* Ahl, p. 158, fig. 1.

Description.—USNM 101725 (topotype), Itatiaia, Rio de Janeiro. Tongue slightly less than one-half the diameter of the very narrow mouth-opening, elongate, not indented on its very free posterior border; snout short, shaped like the half of a hexagon, truncate at the tip from above, slanting backward in profile so that the upper jaw extends considerably beyond the lower; nostrils lateral, almost at the extreme tip of snout, not visible from above, not projecting, separated from each other by an interval equal to their distance from eye. Canthus rostralis prominent although rounded; loreal region flat and vertical, continuous with the line to the upper lip border. Eye large, fairly prominent, with a very heavy upper lid and a rather small aperture; diameter of orbit equal to its distance from end of snout, that of aperture a little less than its distance from nostril; interorbital diameter wider than the broad upper eyelid, a little greater than interval between the nostrils. Tympanum not visible. Fingers distinctly webbed at the base and with lateral ridges, first shorter than second, which is shorter than fourth; tips of fingers not dilated into disks; subarticular tubercles of fingers small but numerous; a large metacarpal tubercle; no pronounced rudiment of a pollex or ridge on forearm; toes webbed at the base and distinctly fringed laterally, the tips not dilated, third and fifth subequal and reaching to base of penultimate phalanx of third; subarticular tubercles on toes small and numerous; outer and inner metatarsal tubercles weak and undifferentiated; apparently no tarsal ridge. Body rather stout and toadlike, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches to axilla; when limbs are laid along the sides, knee and elbow are slightly separated; when hind legs are bent at right angles to body, heels barely touch. Skin above set with flat, coarse, tubercular swellings extending onto the upper surfaces of the limbs and forming apparently a double row on the snout, becoming more evident on sides of head behind corner of mouth and along sides of body; ventral surfaces minutely shagreened anteriorly, with coarse granules on throat and a few on chest and anterior belly; posterior belly nearly smooth; a few indistinct tubercles on posterior femur, and a few smaller, sharper ones around the anus; no supratympanic or dorsolateral glandular ridges; no skinfold across the chest. (No external vocal sac apparent in the male.)

Dimensions.—Head and body length 22 mm.; head length 7 mm., width 7.5 mm.; femur 8 mm.; tibia 8 mm.; foot 8.5 mm.; hand 5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	7	7	7	7	7	7
Mean	30. 4	32. 1	35. 7	37. 4	39. 5	25. 6
Standard deviation	1. 93	1. 17	2. 19	2. 25	2. 75	2. 02
Variation	6. 3	3. 7	6. 2	6. 0	6. 9	7. 9
Standard error	. 73	. 44	. 83	. 85	1. 04	. 76
Range	26. 9– 32. 6	30. 4– 34. 1	32. 7– 39. 1	34. 6– 41. 2	36. 7– 45. 7	22. 7– 29. 8

Color in alcohol.—Dorsum vandyke brown to clove brown, with a pale drab line along posterior part of upper arm ending on the elbow; a pale buff spot below eye extending on the edge of lip to corner of mouth; ventral region pale buff, with a median seal brown spot on center of chin, a paler brown marking across the throat extending behind on the middle of the chest, the adjoining lower surfaces of arm and palm of hand being pale buff except for a brown extension of the dorsal color around the wrists; posterior part of belly and lower surface of femur pale buff, the lower tibia and tarsus colored like the back, the sole of the foot pale buff. The line of demarcation between the dark dorsal and light ventral color is strong on the posterior femur, but less distinct on the sides, owing to the light pigment on the tubercles there.

Variations.—In USNM 101726, from the same place as the described specimen, the skin is smooth, only a trace of the flat dorsal tubercles being visible on the snout. The light spot below the eye is reduced to a minute crescent, and the entire throat and anterior chest are deep clove brown like the back, while the axilla and lower surface of the upper arm are white and emerge from the surrounding dark color like light sleeves from a dark vest. There is also in this specimen a light stripe along the posterior surface of the upper arm that ends in a rather distinct light spot at the axilla; in other features it agrees with the one described. In the original description the maximum of 25 mm. is given. AMNH 33895, 20081, and 20084–5 measure 24, 24, 23, and 24 mm. in length. The three last have exceedingly rough skin on the backs and a wide light dorsolateral stripe quite well marked posteriorly.

Remarks.—As Miranda-Ribeiro remarked in his original description, this species is very distinct from *A. stelzneri*, of which a good series from Uruguay and the Argentine is now at hand. While the color pattern is suggestively similar in the two forms, *stelzneri* has a shorter foot and a very much more spiny skin on the tarsus and foot. Its snout is also much less truncate, seen from above, and the ventral skin is covered with minute spines that become more prominent posteriorly and laterally. Its metatarsal tubercles are both well developed, while neither is developed in *moreirae*, although this feature may be to some extent a result of preservation. The nearest relative of *moreirae* seems to be the Pará form collected by Massart, which I have named *A. moreirae massarti* (Bull. Mus. Hist. Nat. Belgique, vol. 24, No. 24, p. 1, figs. 1, 2, July 1928).

Specimens examined

BRAZIL: Interior of: BM 74.7.16.1–4, Jun.

Rio de Janeiro: Itatiaia, USNM 101725–6, Miranda-Ribeiro; AMNH 33895, A. Lutz; AMNH 20081, 20084–5, Miranda-Ribeiro; BM 1923.11.8.1, Miranda-Ribeiro.

Genus *Brachycephalus* Fitzinger

1826. *Brachycephalus* Fitzinger, pp. 39, 65. (Genotype, *Bufo ephippium* Spix.)

Generic diagnosis.—Pupil horizontal. Tongue elliptical, entire, free behind. Palate smooth. No tympanum. Fingers and toes free. Outer metatarsals united. A broad dorsal bony shield, confluent with the processes of the second to seventh vertebrae. Coracoids and precoracoids slightly divergent; no omosternum; sternum cartilaginous. Diapophyses of sacral vertebra feebly dilated. Terminal phalanges simple.

Brachycephalus ephippium (Spix)

PLATE 1, FIGURES D–F

1824. *Bufo ephippium* SPIX, p. 48, pl. 20, fig. 2 (type locality, Bahia).
1826. *Brachycephalus ephippium* FITZINGER, pp. 39, 65.—WAGLER, 1830, p. 207.—TSCHUDI, 1838, p. 87.—DUMÉRIL and BIBRON, 1841, p. 729.—GÜNTHER, 1858, p. 46.—STEINDACHNER, 1867, p. 35.—ESPADA, 1875, p. 120.—BOULENGER, 1882a, p. 156.—GADOW, 1901, p. 231.—BAUMANN, 1912, p. 161.—MIRANDA-RIBEIRO, 1920e, p. 314, pl.; 1926, p. 177, fig. 95.—L. MÜLLER, 1927, p. 282.—DE WITTE, 1930a, p. 220.—MELLO-LEITÃO, 1937, p. 343.—MYERS, 1946, pp. 15, 32.
1835. *Ephippifer aurantiacus* COCTEAU, p. [12], pls. 7, 8 (type locality, Province of Rio [de Janeiro]).
1835. *Ephippifer spixii* COCTEAU, p. [12], pls. 7, 8 (type locality, Province of Bahia).
1858. *Brachycephalus aurantiacus* GIRARD, p. 100, pl. 5, figs. 20–24.
1920. *Brachycephalus atelopoide* MIRANDA-RIBEIRO, 1920e, p. 313 (type locality, Piquete, São Paulo); 1926, p. 178.
1920. *Brachycephalus nodoterga* MIRANDA-RIBEIRO, 1920e, p. 314 (type locality, Serra Cantareira, São Paulo); 1926, p. 178.
1920. *Brachycephalus garbeana* MIRANDA-RIBEIRO, 1920e, p. 314, pl. (type locality, Serra de Macaé, Rio de Janeiro); 1926, p. 178.
1920. *Brachycephalus bufonoides* MIRANDA-RIBEIRO, 1920e, p. 314 (type locality not given); 1926, p. 178.

Description.—Adult, USNM 97425, Tijuca, city of Rio de Janeiro. Width of tongue about one-half that of mouth-opening, spatulate, without indentation on its very free posterior border; snout short, broadly rounded at the tip when seen from above, nearly vertical in profile; upper jaw not extending beyond the lower; nostrils anterolateral and below canthal ridge, almost at end of snout, separated from each other by an interval twice that of their distance from eye. Canthus rostralis distinct, the loreal region flat and vertical; upper lip also vertical, but with a slight groove marking the upper edge of the maxilla. Eye large, noticeable because of its color, but not projecting much, its diameter about four-fifths its distance from end of snout; interorbital diameter 1½ times the width of upper eyelid, equal to distance between nostrils. Tympanum hidden. Only the third finger well developed, the first and fourth small and almost completely joined to the palm, the second a little longer; no true webs exist, but the fingers are closely bound together by flesh at their bases; tips of second and third fingers pointed, the bases fleshy and conical; no subarticular tubercles on fingers or toes; first and fifth toes similarly reduced to little excrescences on sides of foot; small vestiges of webs between second, third, and fourth toes, with dermal ridges on the sides; no inner or outer metatarsal tubercles or tarsal ridges. Body stout and toadlike, the heavy bony knobs behind the eyes resembling the parotoid glands of a toad; head measured across those knobs about equal to postaxillary width of body; when hind legs are adpressed, heel reaches to posterior corner of eye; when limbs are laid along the body, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels just touch. Skin smooth or minutely glandular excepting over the bony dorsal shields, where it is pitted and rough like the bone with which it is ossified; venter smooth, with some very minute glandular pits on the belly and throat, especially prominent on the chin. (No external vocal sac apparent in the male.)

Dimensions.—Head and body 19 mm.; head length 7 mm., width 7.5 mm.; femur 7.5 mm.; tibia 7.5 mm.; foot 5 mm.; hand 4 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	15	16	16	16	15	14
Mean	33. 8	36. 4	38. 9	41. 8	30. 2	19. 2
Standard deviation	2. 04	2. 75	1. 72	2. 92	2. 17	1. 45
Variation	6. 0	7. 5	4. 4	7. 0	7. 2	7. 5
Standard error	. 53	. 69	. 43	. 73	. 56	. 39
Range	31. 2– 37. 1	29. 7– 40. 0	36. 6– 41. 6	33. 3– 46. 8	26. 3– 35. 5	16. 7– 22. 2

Color in alcohol.—Dorsum and venter uniform pale buff, immaculate. Eyes black and beadlike, the pigment showing distinctly through the thin upper eyelid.

Color in life.—The adult frog from Tijuca, city of Rio de Janeiro, was brilliant, immaculate cadmium orange above, chrome yellow below. The eye was beady jet black. The bonelike saddle on the back was different in texture from the surrounding skin, but similar in color.

Remarks.—This individual and five others from Corcovado, also within the city limits, were examined and compared with nine examples from Petrópolis to find out the effect of age on the development of the bony saddle. Irrespective of their locality, all the adults, measuring 17 to 20 mm. in total length, had the bony plate very strongly developed, although the shape and size of these plates were subject to a good deal of individual variation. The gross form of the bony deposition appears to be typically that of a thickened hourglass across the back, with one or several additional vertebral bony "islands" anterior and posterior to the "stem" of the hourglass, while in a few instances these "islands" have completely fused with the main part of the plate so that it is almost a parallelogram. The head is completely covered with bone except for a little round area behind each upper eyelid. The knobs of bone over the parotoid region are particularly prominent and extend backward beyond the occipital ossification. In the eight younger specimens, measuring from 16 down to 13 mm., the bony development of the back in three of them is like that of the adults in extent, although perhaps is not so great in thickness; in the remaining five a mere patch of bone can be seen on each side of the back, with a slight connecting bar just forming in one. The parotoid patches are distinct from that of the head; in one specimen the latter is completely divided by an unossified median line, and in another the closing is completed anteriorly only. Individual variation is again apparent even in these very young forms, however, as a 15-mm. individual from Petrópolis has only two unconnected small patches on either side of the backbone, while a 14.5-mm. one from Petrópolis has the large rectangular ossified patch like that found in the typical adults of 19 or 20 mm.

The so-called varieties of *Brachycephalus* described by Miranda-Ribeiro as *atelopoide, nodoterga, garbeana,* and *bufonoides,* said to occur with one another or with typical *ephippium,* are properly synonyms of *ephippium* since there is no valid zoogeographic or structural basis on which to separate them.

Several lots of tadpoles are at hand. They are extremely large considering the small size of the adult. One with the limb buds not yet showing has a total length of 48 mm., of which the tail comprises 33 mm. In alcohol they are a uniform buff; in life A. Lutz noted that they were orange in color, looking quite like the yellow tadpoles of *Cochranella eurygnatha* (Lutz). Their eyes are inconspicuous. The adults hide under leaves and fallen tree-trunks in high mountain woods and come out in rainy weather in rather large numbers. Their movements are characteristically slow, and their gait is a slow walk.

Specimens examined

BRAZIL: MHNP 5022 (1); MHNP 778, Eydoux and Souleyet; MHNP 5023 (8), Leprieur; MHNP 5593, Cocteau.

Bahia: Bahia [Salvador], ZSBS 1021/0 (1), Spix.

Districto Federal: Rio de Janeiro: MHNP 02-379, Wagner; AMNH 17416, A. Lutz, January 1930. Corcovado, USNM 96332–6, A. Lutz, 1928. Jardim Botánico, BM 1920.3.20.4, Hill. Tijuca, USNM 97425, A. Lutz, Cochran, Venancio, Jan. 21, 1935.

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96776–8, A. Lutz, 1927–28. Independencia, near Petrópolis, USNM 96431–4, A. Lutz, Nov. 20, 1926; USNM 96435–9, A. Lutz, 1930; USNM 101133, A. Lutz, B. Lutz, Cochran, May 5, 1935. Itatiaia, NHMW, Zerney, October 1927. Mountains of Rio de Janeiro, AMNH 36248, 1930. Paraty, MHNP 8160 (2). Petrópolis, KZAEM 18 D 2036, Ohaus, 1906. Serra da Bocaina, USNM 81159–60, 96639 (tadpoles), A. Lutz, January 1930. Teresópolis, USNM 81161 (tadpoles), A. Lutz, 1930; USNM 96463 (tadpoles), A. Lutz, Apr. 20, 1930; AMNH 20863, Miranda-Ribeiro; ZSBS 7991 (3), April 1914; ZSBS 34/1929 (3), Bresslau, Apr. 3–8, 1929.

São Paulo: Alto da Serra, MRHN 9308 Reg. 51, Massart, September 1922. Piquete, BM 1907.7.29.11–15, Robert.

Genus *Dendrobates* Wagler

1830. *Dendrobates* WAGLER, p. 202. (Genotype, *Dendrobates tinctorius* Wagler.)

Generic diagnosis.—Pupil horizontal. Tongue elongate, entire, free behind. Tympanum more or less distinct. Fingers and toes free, the tips dilated into regular disks. Outer metatarsals united. Omosternum with a weak, semiossified style; sternum cartilaginous. Terminal phalanges T-shaped.

Dendrobates flavopictus (A. Lutz)

PLATE 1, FIGURES G, H

1925. *Hylaplesia flavopicta* A. LUTZ, 1925a, p. 139 (type locality, mountains near Bello Horizonte, Minas Gerais); 1926a, pp. 8, 15.

Description.—Redescription of adult female, IOC (cotype), Bello Horizonte, Minas Gerais. Tongue apparently a little less than one-half the width of mouth opening, oval, not incised on its very free posterior border; snout moderate in length, shaped like the half of a hexagon but with the anterior part slightly rounded when seen from above, bluntly rounded in profile, the upper jaw extending considerably beyond the lower; nostrils lateral and below the bulge of the snout, so that they are not visible from above, not projecting, separated from each other by an interval greater than their distance from eye. Canthus rostralis very prominent, although rounded; loreal region flat and vertical, nearly continuous with the line to the upper lip border. Eye large, deep-set, and not projecting greatly beyond the head, its diameter equal to its distance from end of snout; interorbital diameter equal to the rather wide upper eyelid, a little less than interval between nostrils. Tympanum distinct, about one-half the diameter of eye and lying very near posterior border of eye. Fingers not webbed, first and second subequal, much shorter than fourth and reaching to base of antepenultimate phalanx of third; finger disks only slightly enlarged, with truncate tips; no pronounced rudiment of a pollex, but palmar and metacarpal tubercles well developed; apparently no glandular ridge on forearm; toes free, third much longer than fifth and reaching halfway on the antepenultimate phalanx of fourth, disks slightly enlarged and covering less than one-fourth the tympanic area; an oval inner and a smaller round outer metatarsal tubercle; apparently no tarsal ridges; a distinct narrow fold of skin across heel and knee. Body rather elongate, in postaxillary region apparently a little less than greatest width of head; when hind leg is adpressed, heel reaches to posterior corner of eye; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels touch. Skin of upper part of head and limbs smooth, skin of back set with many coarse, oval glands; a very slight supratympanic swelling; a straight, smooth dorsolateral glandular line from tip of snout to groin; skin of ventral surfaces smooth, excepting for some postanal glands; no skinfold across the chest.

Dimensions.—Head and body 30 mm.; head length 10 mm., width 9 mm.; femur 14 mm.; tibia 15 mm.; foot 14 mm.; hand 6 mm.

Color in alcohol.—Dorsum drab, darkening to sepia on back; on each side a narrow white dorsolateral line beginning at tip of snout extending along canthus, on outer edge of eyelid, above tympanum to groin; between the white dorsolateral lines are two series of white spots, about equidistant from each other and from the dorsolateral lines; similar white spots on the drab upper surfaces of the limbs; posterior femur very light ecru drab, anteriorly with coarse cinnamon reticulations surrounding white spots; ventral surface pale ecru drab, the belly covered with coarse scattered brown spots and reticulations, the throat pale with faint brown mottlings, the lower limb surfaces more or less irregularly spotted with brown; side of head white below the pale brown loreal region.

Remarks.—This species appears to be very rare, according to the collector, Venancio, who found only three examples of it. No eggs or young are known. The adults were found under stones at Lagoa Secca near the Country Club near Bello Horizonte in December. Its voice is very pretty, beginning with a roll, *p-r-r-r-*, then a soft whistle repeated half a dozen times and very high in pitch. Its color in life is distinctive, consisting of white or yellow lateral stripes and golden dorsal spots, while the groin and anterior femur are red. The belly is yellow and white.

The cotype of *D. flavopictus* has been compared with ANS 13414, the example of *D. braccatus* (*D. picta* Duméril and Bibron, fide E. R. Dunn) from Chapada in Mato Grosso, which was identified and discussed by Cope (1887, p. 53). The ANS specimen is 20 mm. long, and the metatarsal and palmar tubercles are a good deal larger than those of the described specimen, although Dunn thinks this may be due to variation or age change. This smaller specimen has the second finger considerably shorter than the first and a small black spot invades the lower surface of the upper arm, neither of which conditions are present in the cotype of *flavopictus*. Other minor differences are that the tympanum appears smaller, the nostril is nearer the tip of the snout, and the adpressed heel reaches to the center of the eye in the ANS specimen. It is possible that these differences might be found unstable if more specimens from both localities were available.

Specimens examined

BRAZIL:

MINAS GERAIS: Bello Horizonte, mountains near, IOC (cotype), A. Lutz.

Genus *Dendrophryniscus* Espada

1871. *Dendrophryniscus* ESPADA, p. 65. (Genotype, *Dendrophryniscus brevipollicatus* Espada.)

Generic diagnosis.—Pupil transverse. Tongue oblong, entire, free behind. Vomerine teeth, none. Tympanum hidden. Fingers and toes webbed at the base, the tips dilated. No omosternum; sternum with a bony style.

Dendrophryniscus brevipollicatus Espada

PLATE 2, FIGURES A, B

1870. *Dendrophryniscus brevipollicatus* ESPADA, p. 65 (type locality, Corcovado, [city of] Rio de Janeiro); 1875, pl. 6, figs. 3, 3, a–f.—BOULENGER, 1882a, p. 274.—GADOW, 1901, p. 224.—BAUMANN, 1912, p. 162.—NIEDEN, 1923, p. 545.—NOBLE, 1926b, p. 1.—MIRANDA-RIBEIRO, 1926, p. 136, figs. 70, 71.—DE WITTE, 1930a, p. 225.—A. LUTZ, 1932a, pp. 775–6.—MYERS, 1946, pp. 15, 32.—CARVALHO, 1949, p. 223.

1920. *Atelopus imitator* MIRANDA-RIBEIRO, 1920e, p. 310 (type locality, Santos, Cubatão, São Paulo).—NOBLE, 1926b, p. 1.—LUEDERWALDT, 1929, p. 39.

1926. *Dendrophryniscus brevipollicatus imitator* MIRANDA-RIBEIRO, p. 139.

1926. *Dendrophryniscus brevipollicatus lauroi* MIRANDA-RIBEIRO, p. 138, fig. 72 (type locality, Angra dos Reis, Rio de Janiero).

1926. *Dendrophryniscus brevipollicatus lutzi* MIRANDA-RIBEIRO, p. 138 (type locality, Corcovado, [city of] Rio de Janeiro).

Description.—Adult female, USNM 96273, Tijuca, Districto Federal. Head anteriorly narrow and pointed, the snout projecting far beyond the front of the lower jaw, slanting backwards in profile, about 1½ times the length of the eye; nostrils lateral, scarcely visible from above, near the snout tip, separated from each other by a distance about equal to the interorbital width; no external tympanum visible; tongue small, equal to about one-fourth the mouth-opening, oval and free behind; canthus rostralis rounded but distinct, loreal region flat and almost vertical; area between anterior parts of canthi concave, with the nasal bones making small elevations on either side; eye large and prominent, projecting moderately, its diameter equal to its distance from nostril; interorbital diameter 1⅔ times the width of upper eyelid, 1⅓ times the distance between nostrils. Fingers webbed at base, first very short, fourth much longer than second, extending almost to base of disk of third, all with dermal ridges along the sides; subarticular tubercles low and flat, not well developed; toes one-fourth webbed, with dermal fringes, third and fifth subequal, reaching halfway to base of antepenultimate phalanx of fourth; inner metatarsal tubercle not developed, outer one an oval flat tubercle; a pronounced inner tarsal ridge extending from first toe to heel and a shorter outer tarsal ridge on the proximal part of tarsus. Body very elongate and slender, in postaxillary region a trifle wider than the head width; when hind legs are adpressed, heel reaches center of eye; when limbs are laid along the body, knee and elbow overlap; when hind legs are bent at right angles to body, heels overlap considerably. Skin minutely glandular, with small scattered pits on the head and middorsal region; a bony ridge above the tympanum but no glandular ridge there; a weak dorsolateral fold along the sides; venter smooth. (No external vocal sac apparent in the male.)

Dimensions.—Head and body 22 mm.; head length 7 mm., width 6 mm.; femur 8.5 mm.; tibia 9.5 mm.; foot 8 mm.; hand 6 mm.

Mathematical analysis (in percentage of total length):

	head length	head width	femur	tibia	foot	hand
Number	18	18	18	18	18	18
Mean	33. 8	29. 1	39. 6	44. 2	37. 1	25. 4
Standard deviation	2. 25	1. 78	3. 06	2. 56	1. 99	2. 44
Variation	6. 6	6. 1	7. 7	5. 8	5. 4	9. 6
Standard error	. 53	. 42	. 72	. 60	. 47	. 58
Range	30. 8– 37. 5	26. 2– 32. 5	33. 3– 45. 0	39. 5– 50. 0	34. 1– 41. 2	19. 4– 28. 6

Color in alcohol.—Dorsum pale wood brown, with an indistinct darker blotch between the shoulders; a dark brown lateral stripe from axilla to groin; femur pale wood brown with a very wide dark brown patch, continued (when legs are bent) across the centers of the tibia and tarsus; venter light ochre, becoming darker posteriorly.

Remarks.—A dozen freshly collected specimens from Alto da Serra, near the type locality of *Atelopus imitator*, were compared with four examples from Tijuca, which is in the city of Rio de Janeiro not far from Corcovado, the type locality of Espada's original material. A careful study failed to bring out any differences of specific or subspecific value in the two populations. Miranda-Ribeiro states that the Alto da Serra form is shorter, the largest specimen in his original series of five measuring 23 mm., while Espada's measurement is 26 mm., but it seems probable that in a larger series from Alto da Serra this small difference might be bridged. He also mentions a "humerolateral fold" as defining *A. imitator*. If he meant to indicate the dorsolateral fold extending from the posterior corner of the eyelid to the groin, then this fold is about equally apparent in the Alto da Serra specimens and in those from Tijuca, appearing best in well-preserved ones, and scarcely showing in the flabby, softened ones. There is no true fold on the humerus or near it on the side of the body in any of the fresh Alto da Serra frogs at hand.

Since the Corcovado specimens on which the name *D. b. lutzi* was based is conspecific with Espada's species from the same locality, *lutzi* automatically becomes synonymous with *brevipollicatus.*

The third specific name proposed by Miranda-Ribeiro, *D. b. lauroi* from Angra dos Reis, must apparently meet the same fate, since the topotypic specimens at hand, when compared with those from Tijuca, show the same variability in the supranasal furrow, which is sometimes evident and sometimes not, and the body is not less slender than that of typical *brevipollicatus*. These frogs in life are a perfect match for the fallen leaves among which they live. When picked up, they stiffen out on their backs with legs extended and "play dead" for as long as one holds them captive.

Some fully metamorphosed young frogs from Alto da Serra measure only 8.5 mm. in total length. They are much paler than the adults, and the pattern hardly shows. The largest adult from that locality is chocolate brown; the others are gray or drab above with a brown X-mark between the shoulders and a Λ on the sacrum. One of the females from Tijuca contained about 20 eggs, each measuring 2 mm. in diameter.

Dr. Bertha Lutz has given me the following notes: "This frog propagates in bromeliads, as its eggs have been found on the undersides of leaves. The tadpoles are small and black. After metamorphosing, the young frog is likewise extremely small, measuring between 5 and 10 mm. The species seems to depend on bromeliads, and does not jump out rapidly like the Hylas if the bromeliads are disturbed. It is a mountain species."

Specimens examined

BRAZIL:

DISTRICTO FEDERAL: Rio de Janeiro, mountains near the city, AMNH 20300–4, A. Lutz, 1923; ZSBS (2), A. Lutz, 1932. Tijuca, USNM 96272–4, 97426, A. Lutz.

RIO DE JANEIRO: Angra dos Reis, USNM 70552–3, 70555–6, Metcalf, October 1925. Guapi, near Teresópolis, USNM 97717, Sandig, April 1935.

SÃO PAULO: Alto da Serra, USNM 96848–52, 97847–55; AMNH 17415; MRHN 9308 Reg. 36b, Massart. Serra do Santos, USNM 96901, A. Lutz, Feb. 27, 1922.

Genus *Noblella* Barbour

1930. *Noblella* BARBOUR, p. 81. (Genotype, *Sminthillus peruvianus* Noble.)

Generic diagnosis.—Readily distinguished from *Syrrhopus limbatus* [=*Phyllobates*] by its blunter snout, less vertical loreal region, by the presence of a tarsal tubercle, longer tibia, and different coloration; from the diskless species of *Syrrhopus*, it may be distinguished externally by the more vertical loreal region and stouter form.

Noblella brasiliensis (Parker)

PLATE 2, FIGURES C–E

1926. *Sminthillus brasiliensis* PARKER, 1926a, p. 201, fig. (type locality, Organ Mountains [Serra das Orgãos, Rio de Janeiro], Brazil).

Description.—Young frog, USNM 97717, Guapi, Teresópolis, Rio de Janeiro. Tongue one-half the width of mouth-opening, spatulate, without indentation on its free posterior border; snout moderately elongate, rounded when viewed from above, slanting forwards in profile, the upper jaw projecting slightly beyond the lower; nostrils anterolateral, midway between tip of snout and anterior corner of eye, separated from each other by an interval equal to 1½ times their distance from eye. Canthus rostralis bluntly rounded; loreal region flat and sloping outwards a little; upper lip flaring slightly outwards. Eye large and prominent, its diameter equal to its distance from tip of snout; interorbital diameter nearly twice the width of upper eyelid, 1⅓ times the distance between nostrils. Tympanum hidden. Fingers not webbed, short, the fourth a mere knob on side of hand, first and second very short; subarticular tubercles few but distinct; toes webbed at the base; first poorly developed, third longer than fifth, with dermal fringes apparent; no pronounced inner or outer metatarsal tubercles or tarsal ridges. Body moderately elongate, in postaxillary region a little narrower than head width; when hind legs are adpressed, heel reaches to center of eye; when limbs are laid along the body, knee and elbow touch; when hind legs are bent at right angles to body, heels touch. Skin minutely pustular above; venter also minutely pustular except on the sides and the anus, where larger granules occur. (No vocal sac apparent in the male.)

Dimensions.—Head and body 12 mm.; head length 5 mm., width 5 mm.; femur 5.5 mm.; tibia, 5.5 mm.; foot 4 mm.; hand 2 mm.

Color in alcohol.—Dorsum wood brown; faint traces of darker crossbands on legs and arms; venter pale buff.

Remarks.—The single example in the U. S. National Museum was examined and identified by Parker. It measures only 12 mm. in total length and thus is apparently not fully grown, as the type is 18 mm. It agrees well with the description of the type, except in having the eye as long as the snout, to be expected in a young individual, and in having the dorsal pattern very indistinct. There are no vomerine teeth, and the tongue is spatulate and free on its posterior part, which is not indented. The dorsal skin on this somewhat dried specimen appears under the lens to be minutely pustular, with a few weak glandules on the sides.

Specimens examined

BRAZIL:

Rio de Janeiro: Barreira, near Teresópolis, ZSBS 548, Bresslau, Mar. 10, 1914. Guapi, near Teresópolis, USNM 97717, Sandig, April 1935. Serra das Orgãos, BM 1902.11.25.8 (type of *S. brasiliensis*), 1902.11.25.9–10 (paratypes), Wagner brothers.

Genus *Phyllobates* Duméril and Bibron

1841. *Phyllobates* Duméril and Bibron, p. 637. (Genotype, *Phyllobates bicolor* Duméril and Bibron.)

Generic diagnosis.—Pupil horizontal. Tongue elliptic or subcordiform, free behind. Vomerine teeth, none. Tympanum distinct. Fingers and toes dilated into regular disks, the upper surface of which bears two rounded cutaneous divisions. Outer metatarsals united. Omosternum cartilaginous; sternum a cartilaginous plate. Terminal phalanges T-shaped.

Phyllobates brunneus (Cope)

Plate 2, Figures f–h

1887. *Prostherapis brunneus* Cope, p. 54 (type locality, Chupada [=Chapada], 30 miles northeast of Cuiabá, Mato Grosso).
1918. *Dendrobates ranoides* Boulenger, p. 428 (type locality, Villavicencio, Colombia).
1920. *Phyllobates brunneus* Barbour and Noble, p. 401.
1922. *Phyllobates subpunctatus* (not of Cope) Ruthven, p. 49.
1923. *Hyloxalus beebei* Noble, p. 289 (type locality, near Kaieteur Fall, British Guiana); 1931, p. 36.
1925. *Eupemphix olfersioides* A. Lutz, 1925a, p. 138 (type locality, littoral of the State of Rio de Janeiro).
1941. *Phyllobates peruvianus* Melin, p. 61, fig. 34 (type locality, Roque, Perú).
1945. *Phyllobates intermedius* Andersson, p. 5, fig. 2 (type locality, Río Pastaza, eastern Ecuador).

Description.—Adult male, USNM 96540 (cotype of *Eupemphix olfersioides*), Angra dos Reis, Rio de Janeiro. Width of tongue about three-fourths that of mouth-opening, spatulate, without indentation on its very free posterior border; snout quite short, broadly truncate at the tip when seen from above, rounded in profile, the upper jaw extending well beyond the lower; nostrils lateral and below the canthal angle, their distance from end of snout about one-half their distance from eye, separated from each other by an interval nearly twice that of their distance from eye. Canthus rostralis rounded but very distinct, the loreal region flat above, but with a diagonal furrow crossing it from nostril to below eye; upper lip quite vertical and in a plane with upper part of loreal region. Eye large and prominent, its diameter equal to its distance from tip of snout; interorbital diameter a little wider than the rather broad upper eyelid, but narrower than distance between the nostrils. Tympanum hidden under the skin, only partly visible when specimen is allowed to become dry, the tympanic area apparently about one-half the diameter of the eye and located immediately behind it. Fingers fairly long, free, not fringed, with small but distinct disks, first and second fingers subequal and decidedly longer than the very short fourth; subarticular tubercles of fingers large; toes distinctly webbed at the base, not fringed, their tips very distinctly swollen into disks equal to about one-fourth the tympanic area, the lower parts of disks rounded, their upper parts with two platelike swellings separated by a Y-shaped median groove; third toe much longer than fifth, reaching halfway to penultimate phalanx of fourth; a short tarsal ridge extending from base of first toe and ending midway on the tarsus in a transverse distinctly thickened ridge which suggests the tarsal tubercle found in some species of *Physalaemus;* a small indistinct inner and a very small outer metatarsal tubercle; subarticular tubercles of toes smaller and less evident than those of fingers. No inguinal or lumbar gland. Body moderately elongate, in postaxillary region equal to greatest width of head; when hind legs are adpressed, heel reaches to posterior corner of eye; when limbs are laid along the body, knee and elbow touch; when hind legs are bent at right angles to body, heels touch. Skin thick and porous above but without any raised glandular lines; ventral surfaces smooth except for a few postanal granules. No external vocal sac apparent.

Dimensions.—Head and body 18 mm.; head length 6 mm., width 5.5 mm.; femur 7 mm.; tibia 8.5 mm.; foot 7 mm.; hand 4 mm.

Mathematical analysis (in percentages of the total length):

	head length	head width	femur	tibia	foot	hand
Number	14	14	13	13	14	13
Mean	35. 2	31. 6	42. 8	46. 0	41. 3	23. 5
Standard deviation	2. 89	2. 19	3. 27	2. 60	3. 02	2. 59
Variation	8. 2	6. 9	7. 6	5. 4	7. 4	11. 0
Standard error	1. 20	. 93	1. 39	1. 10	1. 25	1. 10
Range	31. 4– 40. 9	28. 5– 36. 4	38. 9– 52. 0	42. 5– 50. 0	36. 4– 47. 0	18. 2– 28. 0

Color in alcohol.—Dorsum deep walnut brown; a clove-brown stripe beginning at the nostril, continuing on the loreal region, widening greatly on the tympanic region and covering the side of the body up to the groin; edge of lip below this stripe pale ecru drab; ventral region also pale ecru drab, the line of demarkation very straight and clearcut along the sides between the clove-brown lateral stripe and this ventral tint; limbs light burnt umber above, with a wide crossbar on the tibia; tips of toes a little darker than the dark soles of the feet.

Variations.—A mutilated individual with the same data, USNM 96539, has bleached to an almost uniform drab, otherwise it agrees with the described specimen in size and details of structure so far as can be seen. An additional cotype, USNM 96412, came from Sacco São Francisco near Nictheroy. It has likewise bleached and softened, but its specific characters can quite readily be made out.

A series of frogs was taken at Covanca near Jacarépaguá, in the Federal District about an hour's drive by automobile west of the city of Rio de Janeiro. They were hopping about in the dead leaves with *Leptodactylus marmoratus* near a small impounded pool among dense vegetation. The two largest females are both distended with eggs. The smallest frog in the lot is 11 mm. long, and fully matamorphosed. The specimens are very similar in color, with the dark lateral stripes prominently setting off the paler dorsal tone which ranges from olive to drab-gray, and on which a dark interorbital triangle, a middorsal X and a sacral Λ sometimes make their appearance. The wood-brown femur has a definite diagonal umber crossbar dividing it into two light patches, while the tibia has a similar dark bar running straight across it and dividing it exactly in the middle. The tarsus and foot are also crossbarred. The ventral surface is very sharply set off from the dark lateral stripe, and is pearl-gray in alcohol. The side of the head below the brown lateral stripe is also gray. Anteriorly the femur sometimes has a row of brown spots, or a fairly distinct brown stripe, flecked with paler dots; posteriorly the brown color is not sharply separated from the ventral tone but continues onto the lower surface as a powdering of small brown dots. A more or less distinct short brown stripe occurs on the proximal part of the upper arm.

Remarks.—Nothing is known of the development of eggs or tadpoles, although many halfgrown young have been found. The collector Joaquim Venancio believes that they breed all the year round, as he has always found the young at any season. They frequent the margins of lakes and pools of stagnant water. The voice is like that of a cricket, *pip-pip-pip-pip*, but difficult to distinguish. In life the two stripes along the sides appear to be black, sharply set off from the color of the belly which is white anteriorly and yellow posteriorly. The species *Physalaemus olfersi* which it so closely resembles in color is red below.

I am indebted to Dr. E. R. Dunn for suggesting the identity of the Rio de Janeiro form with *Phyllobates brunneus* from Mato Grosso, Brazil, and from Colombia, Venezuela, and British Guiana.

Specimens examined

BRAZIL:

Districto Federal: Covanca, near Jacarépaguá, USNM 97486–94, Cochran, Dias, Venancio, Feb. 7, 1935.

Rio de Janeiro: Angra dos Reis, USNM 96539–40 (cotypes of *Eupemphix olfersioides*), Pugas, April 1924. Sacco São Francisco, near Niterói, USNM 96412 (cotype of *E. olfersioides*), A. Lutz, 1923.

COLOMBIA: Villavicencio, USNM 118718–9.

Family Bufonidae

Genus *Bufo* Laurenti

1768. *Bufo* Laurenti, p. 25. (Genotype, *Bufo vulgaris* Laurenti.)

Generic diagnosis.—No maxillary or vomerine teeth; a large parotoid gland present; shoulder-girdle arciferous; lateral sacral processes dilated.

Remarks.—Among the several forms of this genus found within the vast limits of Brazil, perhaps the most interesting are the so-called giant toads, classed until recently under the name *Bufo marinus* (Linnaeus). In 1924, Dr. Lutz's collector, Joaquim Venancio, observed that the giant toads in Minas Gerais lived on top of the serra in arid fields several kilometers from the nearest water. This habitat was so very different from that of the Rio de Janeiran form, which always lived near water, that he mentioned the fact to Dr. Lutz, who found structural differences as well, and described the former species under the name of *Bufo paracnemis.* The Spix name *ictericus* seems applicable to the lowland form. Both *ictericus* and *paracnemis* occur in the States of Rio de Janeiro and São Paulo, indicating that they are in reality distinct species, and indeed their differences are so marked that there is likely to be little confusion except between very young ones.

Two fine paratypes of *Bufo pygmaeus* Myers and Carvalho (1952, p. 1; type locality, São João da Barra, mouth of Rio Paraíba, Rio de Janeiro) reached me too late for consideration in the present paper. These miniature toads are related to the forms of *Bufo granulosus.*

For a statistical analysis of measurements of the species of *Bufo* here discussed, see pages 373 and 374.

Key to species of Bufo of southeastern Brazil

a^1. Bony projection on edge of upper jaw directly below tympanum; bony supratympanic crest more or less well developed, sometimes extending backward to cover parotoid . . . . **typhonius** (p. 39)

a^2. No distinct projection on edge of jaw.
  b^1. Upper jaw scarcely extending anteriorly beyond lower jaw.
    c^1. Parotoids rather small; dorsum dark brown, usually with a light midline. **crucifer** (p. 18)

c^2. Parotoids large; dorsum more or less spotted, at least in young.

d^1. Heavy tibial glands present; parotoids twice as long as broad, tapering posteriorly . . . . **paracnemis** (p. 32)

d^2. No tibial glands.

e^1. Parotoids very heavy, almost elliptical, twice as long as broad, rounded posteriorly; nostril a little nearer to tip of snout than to eye; interorbital diameter almost twice that of upper eyelid; tympanum ½ eye diameter . . . . . **ictericus ictericus** (p. 26)

e^2. Parotoids not conspicuously heavy, about 2½ times as long as broad; interorbital diameter 1⅔ times that of upper eyelid; tympanum ⅔ eye diameter . . . . **rufus** (p. 36)

b^2. Upper jaw extending well beyond lower jaw anteriorly.

c^1. Nostrils swollen, giving concave outline to side of snout, as viewed from above; back sometimes spotted but not conspicuously ocellated.

d^1. Tympanum distinct, ½ eye diameter; dorsal tubercles small, numerous, rather evenly distributed over back. **granulosus granulosus** (p. 22)

d^2. Tympanum not distinct, apparently ⅓ eye diameter; dorsal tubercles coarse, some arranged in more or less parallel rows next to mid-dorsal line . . . . **granulosus d'orbignyi** (p. 25)

c^2. Nostrils normal, sides of snout straight; dorsal pattern of several large, dark ocelli with light rims . . . . **ocellatus** (p. 30)

Bufo crucifer Wied

Plate 3, Figures a–c

1821. *Bufo crucifer* Wied, p. 132 (type locality, between São Pedro de Alcântara [Santa Catarina] and Barra da Vereda).—Peters, 1872b, p. 773; 1873a, p. 221.—Boulenger, 1882a, p. 316; 1882b, p. 466; 1886b, p. 443; 1891a, p. 136; 1898a, p. 132.—Boettger, 1892, p. 39.—Peracca, 1896, p. 12.—Berg, 1896, pp. 151, 193.—Andersson, 1906, p. 12.—Wandolleck, 1907, p. 13, pl. 1, figs. 4, 4a, 5, 5a.—Baumann, 1912, p. 96.—L. Müller, 1922, p. 170; 1927, p. 264.—Nieden, 1923, p. 144.—Mertens, 1926a, p. 6; 1930, p. 161.—Brazil and Vellard, 1926, p. 23, photograph.—Miranda-Ribeiro, 1926, p. 134, pl. 18; 1937a, p. 56.—Luederwaldt, 1929, p. 40.—deWitte, 1930a, p. 229.—Vellard and Vianna, 1931, p. 12.—A. Lutz, 1934, pp. 125, 150. pl. 22, fig. 1, pl. 24, pl. 27, fig. 1.—Ahl, 1936, p. 389.—Carvalho, 1937, p. 12.—Mello-Leitão, 1937, p. 331.—Schubart, 1939, p. 56.—Parker, 1939, p. 87.—Myers, 1946, pp. 10, 27.—Travassos, 1945, p. 500.

1822. *Bufo cinctus*—Schinz, 1822, p. 177.—Wied, 1824a, pl. [15]; 1824b, p. 672 (type locality, eastern Brazil, principally Rio Espírito Santo); 1825, p. 564.

1824. *Bufo ornatus* Spix, p. 45, pl. 16, fig. 2 (type locality, Province of Rio de Janeiro).—Wied, 1824a, pl. [61], fig. 2; 1825, p. 558.—Günther, 1858, p. 64.—Steindachner, 1867, p. 46.—Hensel, 1867, p. 147.—Cunningham, 1871, p. 468.—Espada, 1875, p. 204.—Boettger, 1885, pp. 246, 437.—A. Lutz, 1934, pp. 129, 155.—Mello-Leitão, 1937, p. 331.

1824. *Bufo dorsalis* Spix, p. 46, pl. 17, fig. 2 (type locality, Province of Rio de Janeiro).—Hensel, 1867, p. 144.

1824. *Bufo stellatus* Spix, p. 46, pl. 18, fig. 1 (type locality, Province of Bahia).

1824. *Bufo scaber* Spix, p. 47, pl. 20, fig. 1 (type locality, Province of Rio de Janeiro).

1824. *Bufo semilineatus* Spix, p. 51, pl. 21, fig. 1 (type locality, Itapicurú).
1841. *Bufo melanotis* Duméril and Bibron, p. 710 (type locality, Cayenne and Brazil).—Hensel, 1867, p. 148.
1853. *Bufo gracilis* Girard, p. 424 (type locality, Rio de Janeiro); 1858, pl. 6, figs. 16–20.
1860. *Otolophus cinctus* Fitzinger, p. 415.
1862. *Phrynoidis ornatus* Cope, 1862b, p. 358.
1885. *Bufo laevicristatus* Boettger, p. 246 (type locality, Paraguay).
1926. *Bufo crucifer roseana* Miranda-Ribeiro, p. 134, pl. 18, figs. 1, 1a, [*roseanus* on pl. 18] (type locality not given in original description, but stated to be "woods of Rio d'Ouro, State of Rio de Janeiro" by Paulo de Miranda Ribeiro).
1934. *Bufo crucifer stellata* A. Lutz, pp. 127, 153, pl. 22, fig. 2, pl. 27, fig. 5.
1934. *Bufo crucifer henseli* A. Lutz, pp. 128, 153, pl. 23, pl. 27, fig. 2 (type locality, São Bento, Santa Catarina).
1937. *Bufo crucifer mayi* Miranda-Ribeiro, 1937d, p. 69, fig. 5 (type locality, Gavea, Rio de Janeiro).

Description.—Adult, USNM 97540, city of Rio de Janeiro. Tongue elongate, entire, and free for about one-fourth its length posteriorly, one-third the width of the mouth-opening; snout moderately long, slightly rounded when viewed from above, truncate in profile, the upper jaw not projecting beyond lower; nostrils a little nearer to tip of snout than to eye and below the canthus, the openings directed upwards and backwards, separated from each other by an interval equal to their distance from eye. Canthus rostralis marked by a straight, smooth ridge, forking in front of eye to form a preocular crest, continuing above eye as a narrow but sharp ridge with a slight parietal crest jutting from its inner posterior border, its outward branch turning posteriorly to join the rather small parotoid gland by a short postorbital crest; no lateral ridge; upper jaw flaring downwards and outwards at commissure of mouth; interocular space concave. Eye moderate, projecting, its diameter somewhat greater than its distance from end of snout; interorbital diameter 1½ times the width of upper eyelid and 1½ times the interval between nostrils. Tympanum fairly large, very distinct, higher than wide, its height equal to more than one-half the diameter of eye, separated from eye by an interval equal to one-half its own height. Fingers free, with distinct lateral ridges, first finger longer than second and equal to fourth; palmar and subarticular tubercles distinct, the latter single; toes not quite one-third webbed, heavily fringed, third longer than fifth, reaching to base of antepenultimate phalanx of fourth; a small conical inner and a round outer tubercle only slightly smaller; a very distinct tarsal ridge set with fine regular tubercles nearly reaching to heel; subarticular tubercles of toes moderate in size, single. Body rather slender, in postaxillary region somewhat narrower than greatest width of head; when hind leg is adpressed, heel reaches to posterior border of tympanum; when limbs are laid along the sides, knee and elbow nearly meet; when hind legs are bent at right angles to body, heels are barely separated. Skin of dorsum with small scattered tubercles that are a little larger near the midline posteriorly; upper eyelid slightly granular; a row of coarse glandules along dorsolateral line behind parotoid; scapular ridges only slightly indicated; no large tibial gland; ventral regions finely granular, smoother on limbs. No skinfold across chest.

Dimensions.—Head and body 92 mm.; head length 29 mm., width 37 mm.; femur 37 mm.; tibia 37 mm.; foot 37 mm.; hand 22 mm.

Color in alcohol.—Dorsum olive, deepening to burnt umber on both sides of the narrow, pale gray, black-bordered midline which extends from between the eyes to the anus; very faint traces of brown cross-bands on arms and legs; sides of head seal brown except for a wide pale-gray area from eye to edge of upper lip; a pale posttympanic spot; a narrow brown line below supratympanic ridge and others bordering the pale area below eye; lower edges of glands along dorsolateral line dark seal brown; sides of body mottled with olive and buff; ventral surfaces buff, with traces of two narrow longitudinal lines on center of throat. Bottoms of hands and feet olive, the webs between the toes buff.

Remarks.—The dorsal pattern of this species is subject to a great deal of variation, as has already been emphasized. The middorsal line may be completely lacking, and the back may be entirely uniform in color, usually drab or olive. There may be more or less distinct paired dark spots beside the midline, or these spots may be fused into longitudinal stripes, having the outermost border very irregular and the inner border next to the midline very deeply pigmented and fairly straight. The head markings are much less variable, and in all except bleached specimens the wide whitish patch under the eye is set off by the dark brown loreal and temporal patches.

A specimen from Pernambuco, USNM 57786, is pale and immaculate on the back, with vestiges of dark and light marblings on the posterior femur, while each of the numerous tubercles is set with a little spiny point so that the entire body seems very rough. In contrast to this is USNM 97772, an adult female from Alto da Serra, São Paulo, which has an irregular pattern of anastomosed brown spots on either side of a narrow light vertebral line that divides at the anus and continues as a narrow white line down the nearly immaculate, drab posterior femur. The skin of this specimen is fairly smooth, except for some small tubercles on the head and on the upper parts of the limbs. In structure, the only apparent difference is the much smaller parotoid in the São Paulo toad, a purely individual difference, in all probability

In the half-dozen young toads from São Paulo the skin is normally roughened with tubercles, the parotoids are normally large and no postfemoral light line is visible, although the dark dorsal spots appear definitely to arrange themselves in a line on either side of the light middorsal area. An example from Guapi, near Teresópolis, in the State of Rio de Janeiro, USNM 97664, has the same dorsal and postfemoral coloring as the female, USNM 97772, from São Paulo, and its skin is also not very rough. Three other specimens from Guapi show a weak dorsal pattern and no postfemoral lines, while the remaining five are quite uniform in color on the entire dorsal and postfemoral areas, with skin usually somewhat rough and occasionally spiny. A half-grown toad from Manguinhos shows a dorsal pattern; three adults from Caxias a short distance away are unicolor, although one has a light middorsal line (*B. dorsalis* Spix). A series of eight adults labeled simply "Rio de Janeiro" vary in the same way, five without dorsal pattern (*B. scaber* Spix) and three with vestiges of a pattern or a strongly developed one (*B. ornatus* Spix), the skin ranging from nearly smooth to spiny.

The two adults from Juiz da Fóra, in Minas Gerais, as well as one of the two from San Salvador, in Bahia, show some yellow spots on the femur and sides, somewhat as illustrated by *B. stellatus* Spix. The second adult from San Salvador and the one from Pernambuco already mentioned are ashy in color, with scarcely any trace of lighter spots on these regions. A very large series of toads from all the States of eastern and southern Brazil must be examined before the local degree of variation can be properly analyzed.

No specimens are at hand from Gavea, near the city of Rio de Janeiro, which is the type locality of *B. crucifer mayi* Miranda-Ribeiro. Of the several specimens from other nearby localities, none shows the dark spots invading the middorsal region as shown in the figure of *mayi*. Only a large series of toads from Gavea can settle the fixity of this color character.

The same need for more material is felt in regard to establishing fully the variety *B. crucifer henseli* Lutz from São Bento, in Santa Catarina, and the variety *B. c. roseana* Miranda-Ribeiro, for which no definite type locality was stated, but which is from Rio D'Ouro.

Although the type of Girard's *B. gracilis* from Rio de Janeiro is no longer in existence, the descriptions and figures which he gave in his amended notes of 1858 make it clear that his specimen belonged to the species named *B. crucifer* by Wied in 1821.

Specimens examined

BRAZIL: MHNP 4982 (2), Eydoux; MHNP 4985 (2), Vautier.

Bahia: ZSBS 134/0, Spix. São Salvador, USNM 98842–3, Dias, Apr. 19, 1935; USNM 102327–9.

Districto Federal: Rio de Janeiro: USNM 70609–17, Metcalf, Oct. 28, 1925; USNM 96351, 1920; MZUM 64542 (part); MHNP 4983, Gaudichaud; MHNP 4984, Gallot; ZSBS 86/25, A. Lutz, 1924; ZSBS 724/20 (2), Bresslau, 1913; ZSBS 104/32 (2), A. Lutz, March 1932; MHNP 622–3, Gaudichaud and Gallot. Corcovado, USNM 81141, 1930. Jardim Botánico, MRHN IG 9308 Reg. 36g, Massart, December 1922. Manguinhos, USNM 96119–20, A. Lutz. Pico de Tijuca, MZUM 104287, Bailey, 1941. Rua Salvator Correio, USNM 97540, Dias, February 1935. Santa Alexandrina, USNM 97458, B. Lutz, Cochran, and Venancio, Feb. 1, 1935.

Espirito Santo: Mimoso, ZSBS (2), Bresslau, September 1913; ZSBS 469/1920, Miller, 1918. Santa Leopoldina, ZSBS 37/1920, Schlüter, 1903.

Minas Gerais: Juiz de Fóra, USNM 96909–10, February 1934.

Pernambuco: ZSBS 720/20, Bresslau, May 5, 1914; USNM 57786, December 1895.

Rio de Janeiro: ZSBS 2691/0 (2; cotypes of *B. ornatus*), Spix. Angra dos Reis, USNM 96477, Apr. 27, 1924. Barro Branco, MZUM 104288, Bailey, 1941. Caxias, USNM 97394–6, Pasarelli, March 1935. Guapi, near Teresópolis, USNM 97633–70, Sandig, March–April, 1935. Montserrat, Serra do Itatiaia, AMNH 17023, Holt. Teresópolis, ZSBS 799.

Santa Catarina: Humboldt, ZSBS 297/1920 (2), 339/1920, Erhardt, 1920.

São Paulo: Alto da Serra, USNM 97780, A. Lutz, March 1922; USNM 97772, Cochran and Venancio, Apr. 26, 1935; USNM 97773 (eggs), Cochran and Venancio; USNM 102315–6; MRHN IG 9308 Reg. 36, Massart, September 1922. Bertioga, USNM 123401–6, Sawaya. Iguapé, CM 2601, Haseman, Dec. 15, 1908. Ilha Bella, near Santos, USNM 123903–7, Sawaya. Juquiá, 8 km. north of, MZUM 104296–7, Bailey, 1941. Piquete, BM 1907.7.29.25, Robert. Raiz da Serra, USNM 102317–9. Rio Grande, USNM 102320–1. Rio Mogy, CM 2605, Haseman, July 28, 1908. São Paulo, CM 2601.

Bufo granulosus granulosus Spix

Plate 3, Figures d–f

1799. *Bufo scaber* (part) Schneider, p. 223.

1824. *Bufo granulosus* Spix, p. 51, pl. 21, fig. 2 (type locality, Bahia).—Günther, 1858, p. 67, pl. 5, fig. 4.—Peters, 1863, p. 80; 1873a, p. 222.—Cope, 1874, p. 120; 1899, p. 3.—Boulenger, 1882a, p. 324; 1889, p. 247; 1894, p. 348; 1898b, p. 126.—Boettger, 1892, p. 39.—Peracca, 1895, p. 29; 1897, p. 18.—Méhely, 1904, p. 225.—Lidth de Jeude, 1904, p. 93.—Baumann, 1912, p. 162.—Ruthven, 1922, p. 55.—Nieden, 1923, p. 145.—Cott, 1926, p. 1159.—Brazil and Vellard, 1926, p. 23.—A. Lutz, 1927, pp. 42, 57, pl. 8.—deWitte, 1930a, p. 229.—Tate, 1932, p. 244.—Parker, 1936, p. 1.—Müller and Hellmich, 1936, p. 7.—Schubart, 1939, p. 56.—Travassos and Freitas, 1942, p. 283.

1824. *Bufo globulosus* Spix, p. 48, pl. 19, fig. 1 (type locality, Itapicurú River).—Peters, 1873a, p. 225.—Miranda-Ribeiro, 1926, pp. 133, 215; 1937a, p. 56.—A. Lutz, 1934, pp. 124, 149, pl. 25.—Parker, 1935, p. 509.—Mello-Leitão, 1937, pp. 31, 342.—Carvalho, 1937, p. 12.—Schubart, 1939, p. 56.

1828. *Chaunus marmoratus* WAGLER, columns 740–44.
1830. *Chaunus globulosus* WAGLER, p. 205.
1833. *Bufo nasutulus* WIEGMANN, column 656 (no type locality given).—STEINDACHNER, 1867, p. 45.
1841. *Bufo strumosus* DUMÉRIL and BIBRON (part), p. 718 (type locality, Rio de Janeiro, Cayenne, and Santo Domingo).
1862. *Phrynoidis granulosus* COPE, 1862b, p. 358.

Description.—Adult male, USNM 98245, Pirapora, Minas Gerais. Tongue elongate, spatulate, one-third the width of mouth-opening, free behind; snout short, truncate at the tip when viewed from above and in profile, very much swollen in the nasal region; upper jaw projecting considerably beyond lower; nostrils almost at the tip of snout, more superior than lateral, horizontal, bounded beneath by a heavy bony ridge, separated from each other by an interval equal to their distance from eye. Canthus rostralis marked by a thin curving ridge, forking in front of the eye to form a strong continuous ridge in front of and below eye and a narrow supraocular ridge which continues behind the eye, bifurcating into a rather weak parietal ridge and a strong supratympanic ridge which merges with the small parotoid gland; no definite curved row of tubercles from corner of mouth to parotoid. Eye large and prominent, its diameter equal to its distance from end of snout; interorbital region concave, its width 1½ times that of upper eyelid, and twice that of interval between the nostrils. Tympanum small, distinct, its diameter one-half that of eye, separated from eye only by the narrow postocular ridge. Fingers free, with serrated lateral fringes, not dilated, first and second subequal, shorter than fourth, which reaches to base of penultimate phalanx of third; no pronounced pollex; an oval tubercle on base of first finger and a much larger round one on palm; subarticular tubercles prominent, the proximal ones single, the distal ones double; toes one-third webbed, fringed, their tips not dilated, third slightly longer than fifth, reaching to base of antepenultimate phalanx of fourth; inner and outer metatarsal tubercles subequal, conical, small but prominent; subarticular tubercles not well distinguished from the other metatarsal warts, apparently single proximally and double distally; no pronounced tarsal ridge. Body stout, in postaxillary region about 1¼ the greatest head width; when hind legs are laid along the sides, heel reaches almost to posterior tympanic border; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are bent at right angles to the body, heels touch. Dorsal skin closely set with tubercles, some larger ones between the shoulders; no especially heavy sacral gland; venter finely granular anteriorly, coarsely so on posterior abdomen and lower femur; parotoid glands elongate, straight, extending as far back as the axilla, coarsely tuberculate. A loose fold of skin at center of throat marking the presence of an external vocal sac.

Dimensions.—Head and body 51 mm.; head length 15 mm., width 17 mm.; femur 18 mm.; tibia 18 mm.; foot 17 mm.; hand 11 mm.

Color in alcohol.—Dorsum pale ashy buff, with many small dark spots at the bases of the tubercles, forming a coarse dark network on the sacrum; dark bars across the top of the legs and dark irregular stripes on sides and on posterior femur; venter, including soles and palms, immaculate pale buff; center of throat of male suffused with dark.

Remarks.—The material at hand indicates that Müller and Hellmich were right in considering *Bufo d'orbignyi* Duméril and Bibron as a subspecies of *B. granulosus.* The main differentiating character seems to be that in the southern form *d'orbignyi,* at least in the Argentine and Uruguayan specimens at hand, as well as the single specimen from the State of São Paulo in Brazil, the dorsal tubercles are coarse and some of them are arranged in more or less parallel rows next to the pale middorsal line. Topotypic examples of the northern form from Bahia as well as from Minas Gerais have the pale dorsal line faintly indicated but not set off by any conspicuous arrangement of the tubercles, which are smaller and more numerous than in *d'orbignyi,* and more uniformly distributed over the back. The parietal crest is scarcely developed or faintly indicated by a few small tubercles in Bahia toads. In the southern form this crest is usually evident, or at least it is marked by two or three fairly large tubercles. The tip of the snout in the region of the nostrils is usually somewhat bulbous and swollen in typical *granulosus,* while in *d'orbignyi* the outline of the snout is nearly normal. Although the specimens of *d'orbignyi* at hand are insufficient to give an adequate picture of its variability, certain specimens of the northern form show a decided tendency toward the *d'orbignyi* characters, since some of them have weakly developed parietal crests while there is often more than a suggestion of longitudinal rows of tubercles on each side of the dorsal line. The largest *d'orbignyi* from Montevideo, USNM 70618, measures 63 mm. in total length; the largest from Argentina, USNM 97188, is 58 mm. long. The largest *granulosus* from Bahia is 55 mm., while the one from Panamá, USNM 53739, is 59 mm. in length. In both *granulosus* and *d'orbignyi* the parotoids are less well marked than in most toads.

Specimens examined

BRAZIL:

AMAZONAS: Abura, Pôrto Velho, MZUM 56777. Lower Amazônia, USNM 28932–7, Steere.

BAHIA: Bahia, USNM 97107–9, Venancio, 1923–24. Itaeté, MRHN IG 9404, Reg. 71, Massart, December 1922. Joazeiro, USNM 98839, Dias, April 16, 1935. Toca da Onça, USNM 52613–4, Rose, June 27, 1915.

CEARÁ: Fortaleza, MHNP 8159 (1).

Minas Gerais: Jauuária, USNM 98807–11, Apr. 11, 1935, Dias. Pirapora, USNM 98244–6, Cochran, Dias, and Venancio, Mar. 22–23, 1935. São Francisco, USNM 98805, Dias, Apr. 10, 1935.

Pará: Soure, on Marajó Island, AMNH 46196–7, Hassler, Feb. 26, 1938.

Pernambuco: USNM 57877, December 1895. Papera, USNM 97059–64, Pickel, June 30, 1931.

Rio Grande do Norte: Natal, USNM 81140, A. Lutz, July 1930.

BRITISH GUIANA: Mount Roraima, AMNH 3750, Crampton, Aug. 15, 1911.

COLOMBIA: Atlántico, USNM 117515, Hershkovitz, April 1943. Guajira, Sierra Maciuti, USNM 115380, Wetmore and Carriker 1941.

PANAMÁ: Rio Calobré, USNM 53739, Meek and Hildebrand, Mar. 18, 1911.

VENEZUELA: Maracay, USNM 97193–5, A. Lutz, 1925.

Bufo granulosus d'orbignyi Duméril and Bibron

Plates 3, Figures g–i, 34, Figure f

1841. *Bufo d'orbignyi* Duméril and Bibron, p. 697 (type locality, Montevideo).—Hensel, 1867, p. 141.—Weyenbergh, 1876, p. 166.—F. Müller, 1882, p. 138.—Boulenger, 1882a, p. 322; 1885a, p. 196.—Cope, 1885a, p. 185.—Boettger, 1885, p. 34; 1892, p. 39.—Andersson, 1906, p. 14.—Baumann, 1912, p. 162.—Nieden, 1923, p. 143, fig. 191.—Mertens, 1926a, p. 5, fig. 2; 1926b, p. 4.—Brazil and Vellard, 1926, p. 23.—Miranda-Ribeiro, 1926, p. 132.—Marelli, 1931, p. 201.—A. Lutz, 1934, pp. 123, 148, figs. 1, 1a.

1847. *Bufo orbignyi* Bibron, p. 11, pl. 15, figs. 5–7.

1875. *Chilophryne d'orbignyi* Espada, p. 188.

1886. *Bufo dorbignyi* Boulenger, 1886b, p. 443.—Berg, 1896, pp. 151, 196.—Marelli, 1924, p. 586.—Mello-Leitão, 1937, p. 342.

1936. *Bufo granulosus dorbignyi* Müller and Hellmich, p. 12.

1948. *Bufo granulosus d'orbignyi* Rengel, p. 279.

Description.—USNM 102314, Alto da Serra, São Paulo. Tongue elongate, spatulate, over one-third the width of mouth-opening, free behind; snout short, truncate at tip when viewed from above and in profile, the upper jaw extending considerably beyond lower; nostrils almost at the end of snout, horizontal, superolateral, bounded beneath by a short bony ridge, separated from each other by an interval equal to their distance from eye. Canthus rostralis marked off by a ridge formed of a double row of elongate tubercles, forking in front of the eye to form a vertical preocular ridge, the other fork continuing backwards as a sharp supraorbital crest which diverges posteriorly and again forks, the inner fork ending in a short, sharp parietal ridge, the outer continuing above ear and merging with the small oval parotoid gland; a sharp irregular ridge encircling orbit; a curved row of round tubercles from corner of mouth to parotoid gland. Eye large and prominent, a little longer than its distance from end of snout; interorbital region deeply concave, its width almost twice that of upper eyelid and much greater than interval between the nostrils. Tympanum small, not very distinct, its diameter apparently one-third that of eye, separated from eye by an interval nearly equal to its own diameter. Fingers free, with serrated lateral fringes, not dilated, first shorter than second, which is shorter than fourth and reaches base of penultimate phalanx of third; no pronounced pollex; an oval tubercle on base of first finger and a much larger round one on palm; subarticular tubercles very distinct, usually single proximally but double under distal phalanges; toes one-third webbed, fringed, their tips not dilated, third longer than fifth, reaching a little beyond base of antepenultimate phalanx of fourth; inner and outer metatarsal tubercles subequal, conical, prominent; subarticular tubercles double distally, single proximally; no tarsal ridge. Body stout, in postaxillary region 1⅓ times the greatest width of head; when hind leg is adpressed, heel reaches to axilla; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels overlap. Dorsal skin closely set with tubercles, some larger ones on center of head and behind the parietal crests; a heavy gland on each side of sacrum; venter finely granular; parotoid glands low, short, not well marked except by the larger tubercles covering them. Some transverse folds of loose skin across throat and abdomen.

Dimensions.—Head and body 30 mm.; head length 8 mm., width 11 mm.; femur 9 mm.; tibia 10 mm.; foot 11 mm.; hand 7 mm.

Color in alcohol.—Dorsum uniform fawn color, venter buff; faint darker lateral stripes on back.

Remarks.—A discussion of this form appears with that of *Bufo granulosus granulosus* Spix.

Specimens examined

BRAZIL:
  Rio Grande do Sul: Pôrto Alegre, KZAEM 2525 (3), Emrich.
  São Paulo: Alto da Serra, USNM 102314 (formerly IB 757).
ARGENTINA: Buenos Aires, USNM 97188, 1929; MRHN IG 4792, Reg. 205, Gerrard. La Plata, USNM 22750, Museo de La Plata.
URUGUAY: Malvin, near Montevideo, USNM 65593–4, Felippone. Montevideo, USNM 70618, Metcalf, Nov. 15, 1925; USNM 65576, 65578–80, Felippone; MHNP 4960 (type of *Bufo d'orbignyi*).

***Bufo ictericus ictericus* Spix**

FIGURE 1; PLATE 4, FIGURE E

1824. *Bufo ictericus* SPIX, p. 44, pl. 16, fig. 1 (type locality, Rio de Janeiro).—BRAZIL and VELLARD, 1926, p. 14.—TRAVASSOS, 1944, p. 128.

1841. *Bufo agua* (not of Lacépède) var. c, DUMÉRIL and BIBRON, p. 705 (specimens from Brazil).—WIED, 1824a, plate, figs. 1, 2; 1824b, p. 672.

1860. *Docidophryne icterícus* (part) FITZINGER, p. 415.

1882. *Bufo marinus* (not of Linnaeus) BOULENGER, 1882a (part), p. 316 (specimens from Rio de Janeiro).—NIEDEN 1923 (part), p. 138.—MIRANDA-RIBEIRO, 1926 (part), p. 134.— ? BRAZIL and VELLARD, 1926, p. 14, pls. 3, 4.—A. LUTZ, 1934 (part), p. 115, pls. 13, 14, 19, 26, fig. 2.—MYERS, 1946, pp. 10, 27.

1927. *Bufo marinus ictericus* L. MÜLLER, p. 261.—MERTENS, 1930, p. 161.

Description.—Adult male, USNM 97740, Valvera, near Nova Friburgo, Rio de Janeiro. Tongue elongate, oval, about one-third the width of mouth-opening, entire and free for over half its length behind; snout short, rounded when viewed from above or in profile, the upper jaw scarcely extending beyond lower; nostrils a little nearer to tip of snout than to eye and just below canthus, the openings directed upwards and backwards, separated from each other by an interval greater than their distance from eye. Canthus rostralis marked by a very heavy ridge forking in front of eye as a preocular crest, continuing above the eye, and then turning outwards behind it as a postocular crest, a short branch running into the large, elliptical, posteriorly

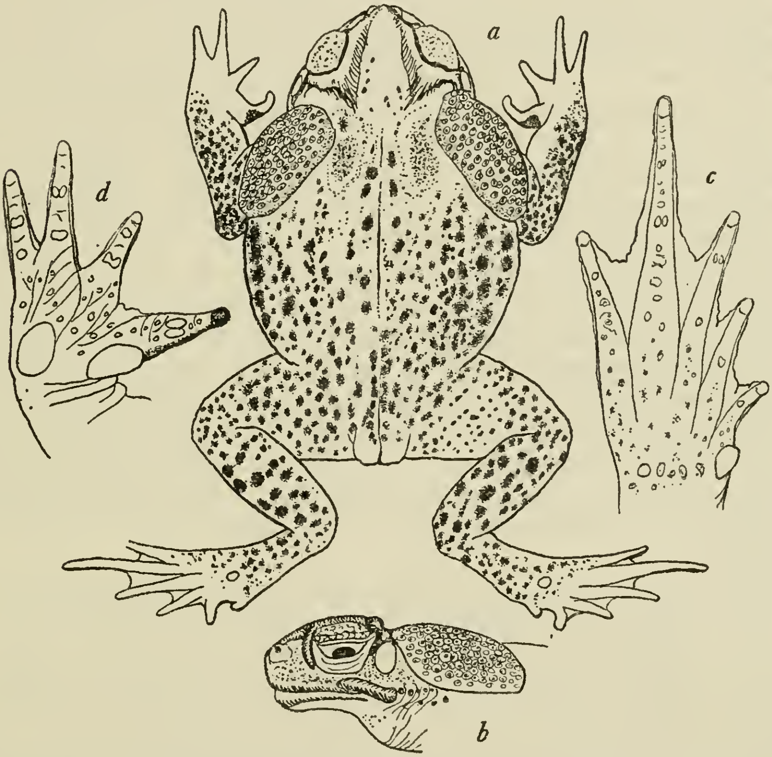


FIGURE 1.—*Bufo ictericus ictericus*, USNM 97740: *a*, Dorsum × ½; *b*, profile × ½; *c*, foot × 1; *d*, hand × 1.

rounded parotoids, which are twice as long as broad and extend back to the level of the axilla; parietal crests short, poorly developed; a heavy ridge along upper lip; interorbital space concave below level of ridges. Eye moderate, projecting slightly beyond the plane of the surrounding ridges, its diameter slightly more than its distance from end of snout; interorbital diameter nearly twice the width of upper eyelid and twice the interval between nostrils. Tympanum small, one-half the eye diameter, distinct, higher than wide, separated from eye by a space equalling half its greatest diameter. Fingers free, with traces of lateral ridges distally, first finger slightly longer than second and equal to fourth; a round tubercle at base of first finger, and a less distinct but larger one on palm; subarticular tubercles moderate, the basal as well as distal ones double or semidivided; toes one-third webbed, heavily fringed, third longer than fifth, reaching halfway to penultimate phalanx of fourth; a conical projecting inner and a small weak outer metatarsal tubercle; a faint short tarsal ridge fading out midway to heel, subarticular tubercles small, double. Body stout, in postaxillary region 1½ times the greatest width of head; when hind leg is adpressed, heel reaches to shoulder; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are bent at right angles to body, heels touch. Skin of dorsum with scattered low warts covered with groups of small spines, the intervening skin smooth, these warts forming an irregular row on each side of the indented midline anteriorly, and (in this specimen) a more distinct lateral row behind each parotoid; upper eyelid coarsely granular but not spiny; scapular ridges very indistinct; no tibial gland; throat and chin finely granular, belly coarsely granular, lower part of legs nearly smooth. A slight skinfold across the chest indicating the presence of an external vocal sac.

Dimensions.—Head and body 121 mm.; head length 33 mm., width 47 mm.; femur 49 mm.; tibia 47 mm.; foot 50 mm.; hand 31 mm.

Color in alcohol.—Dorsum raw umber, the head crests and aggregations of spines on back and limbs clove brown; venter raw umber, throat immaculate; very coarse dark brown reticulations over chest, belly, and lower surface of femur; lower parts of hands and feet seal brown, the tips of toes and fingers black; ridge of upper lip clove brown.

Variations.—The female has a dorsal raw-umber ground color like the male, but this appears only in the midline and on the head and parotoids and in a wide lateral stripe, the intervening space on the back being deep clove brown with a few scattered light spots, while a broad brown band below the wide lateral light stripe merges gradually with the heavy reticulate ventral pattern that sometimes extends on to the throat and along the entire lower parts of the limbs. A female evidently formed the basis for the Spix figure of *Bufo ictericus*.

Among the sixteen specimens from Nova Friburgo, the scapular ridges are distinct in only one. The warts are fairly continuous down the sides behind the parotoids in a little over half the specimens, this character being very fluctuating in this species as well as in *B. paracnemis*.

Other examples from Guapi near Teresópolis agree very well with these, as do likewise those from São Paulo. It was interesting to note that well-marked individuals of *paracnemis* were found in the same places as *ictericus*, proving the ability of both to exist as distinct species without intergrading. Apparently *ictericus* frequents streams all of the time while *paracnemis* roams widely on the drier parts of the mountain ridges except during the actual breeding season when it also must resort to the water. It seems to be the predominant form in the States of Rio de Janeiro and São Paulo.

If specific distinction were based solely on the shape and size of the parotoid glands of the giant toads, it would still be possible to separate most of the individuals at hand, for the parotoids do not vary so much in these groups when separated geographically as has been heretofore believed. A survey of sixteen *B. ictericus* from Nova Friburgo shows the parotoids to be elliptical (that is, posteriorly rounded) in all but one specimen, in which they are more elongate. The parotoids are between 28 and 35 percent of the total length in these adults, averaging 32 percent. In 38 *B. paracnemis* from Minas Gerais, the length of the parotoids was 23 to 31 percent of the total length, averaging 26 percent, and they tapered posteriorly in all but two specimens, in each of which the tapering was slight. The latter species can of course be distinguished at once by the possession of the large tibial gland not present in *ictericus*. The northern form from Amazonas and Rio Negro, to which the name *B. marinus* is apparently correctly applied, has the parotoids much wider and also much shorter, their average being 24 percent of the total length in eleven from Lower Amazonia, and 22 percent in seven from Rio Negro. *B. ictericus* seems to be completely divided geographically, at least in eastern Brazil, from the northern *marinus* by the species *paracnemis*, which occupies Minas Gerais, Bahia, and Pernambuco, living in dry upland regions which are impossible to the more aquatic *marinus* and *ictericus*.

Specimens examined

BRAZIL:

Bahia: MRHN IG 9308 Reg. 34b (14). Salinas, USNM 119111–2, Johnson, February 1944.

Districto Federal: Pico de Tijuca, MZUM 104298, Bailey, 1941. Recreio dos Bandeirantes, USNM 97574, B. Lutz, Cochran, and Venancio, Feb. 10, 1935.

Rio de Janeiro: MZUM 64542 (part); MRHN IG 9308 Reg. 34, 34d, and 34z (10). Barreira, ZSBS 2091, February 1914. Bonito, Serra da Bocaina, USNM 96440–1, A. Lutz, February 1928. Guapi, near Teresópolis, USNM 97652–5, 97657–9, 97661–2, 97671–4, Sandig and Buchwald, March–April, 1935. Petrópolis, ZSBS 67/26 (2), Princess Therese. Serra do Itatiaia, AMNH 16990–3, 17021–2, 17058. Teresópolis, ZSBS 802/20, Bresslau. Valvera, near Nova Friburgo, USNM 97730–46, 103220, 101139, B. Lutz, Cochran, and Venancio, May 9–13, 1935.

São Paulo: Agua Quente, CM 2548, Haseman, Nov. 29, 1908. Alto da Serra, MRHN IG 9308 Reg. 34g, Massart, October 1922. Bertioga, USNM 123407–11, Sawaya. Fazenda São Agostinho, São José dos Campos, near Taubaté, USNM 100946–7, Pessoa, July 10–11, 1935. Fazenda Schmidt, near Ribeirão Preto, USNM 100951, and 100955, Apr. 4–10, 1935. Ribeirão Pires, ZSBS (2), Bresslau, November 1913. São Paulo, USNM 100950, 100952, 100954, 100957, 100960, 100963–8, Worontzow, July 10–12, 1935. Taubaté, USNM 100948–9, 100953, 100958–9, 100961–2, Worontzow, June 1935.

Bufo ocellatus Günther

Plate 4, Figures a–d

1858. *Bufo ocellatus* Günther, p. 64 (type locality, Brazil).

1882. *Bufo typhonius* (not of Linnaeus) Boulenger, 1882a, pp. 317, 318.—Nieden, 1923, p. 140.

Among the specimens of *Bufo typhonius* in the collection of the British Museum is the skin of a toad, stuffed with cotton and preserved in alcohol, which had served as the basis for Günther's description of *B. ocellatus*. This skin matched 2 specimens from Minas Gerais that I received for study from the Instituto Butantan. As the bodily proportions and many other diagnostic features are not apparent in this skin, which is the type of *ocellatus*, a complete redescription of a fresher specimen is given.

Description.—Adult female (with eggs), USNM 121334, from Januária, Minas Gerais. Tongue elliptical, very elongate, about one-third width of mouth-opening, entire and free for its posterior half; snout short, its sides forming a right angle and its tip somewhat truncate when viewed from above, bluntly rounded in profile, the upper jaw extending well beyond the lower; nostrils nearly at tip of snout and just below canthus, the openings superolateral, separated from each other by an interval equal to their distance from eye. Canthus rostralis marked by a rather weak arc-shaped ridge joining a somewhat heavier supraocular crest, thickening on its inner posterior border into a short parietal crest and continuing outward and posteriorly to form a short distinct postorbital crest; preocular crest not evident; interocular space flat and below level of ridges; parotoid small, rounded, not larger than the upper eyelid, extending only to level of shoulder; eye moderate, projecting beyond surrounding ridges, its diameter equal to its distance from end of snout; interorbital diameter about twice the width of upper eyelid, three times the interval between nostrils. Tympanum not distinct in outline, apparently higher than broad, as high as the diameter of the eye and very close to it. Fingers free, with lateral ridges distally, first and second fingers subequal and shorter than fourth; a large palmar tubercle, and a smaller one beside it at base of first finger; subarticular tubercles of fingers quite prominent, some double and some single; toes webbed at the base, with a lateral series of minute tubercles, third and fifth subequal, reaching to base of penultimate phalanx of fourth; a small oval inner and a round outer metatarsal tubercle; no tarsal ridge; subarticular tubercles of toes small, all single. Body stout, in postaxillary region nearly twice the greatest width of head (in female distended with eggs); when hind leg is adpressed, heel fails to reach axilla, and tip of fourth toe barely reaches end of snout; when limbs are laid along the sides, knee and elbow are separated by an interval equal to length of tibia; when hind legs are bent at right angles to body, heels are sidely separated. Body completely covered with small tubercles, slightly larger along the dorsolateral line and around anus, smaller on sides and on lower surface of legs. No obvious scapular ridges; no tibial gland; no skinfold on chest. A pair of very prominent tubercles just over the anus.

Dimensions.—Head and body 59 mm.; head length 16 mm., width 20 mm.; femur 22 mm.; tibia 19 mm.; foot 20 mm.; hand 14 mm.

Color in alcohol.—Dorsum deep fawn color; a row of four or five black ocelli surrounded by a pale border on each side of the midline, other ocelli nearer the dorsolateral region; legs and arms with black crossbands separated by light areas; a narrow, median, light line from snout to anus; ventral region with a coarse dark and light reticulation, center of throat dusky, edges of lips fawn color; warts along lateral line and below anus light, evidently orange or red in life.

Variations.—A smaller individual, IB 398, agrees in all essential characteristics with the specimen just described.

Remarks.—This species is apparently not closely related to any other Brazilian form, although superficially it somewhat resembles *B. granulosus* and *B. g. d'orbignyi* in stoutness of body and in limb proportions. Its characteristic pattern distinguishes it at once from all other Brazilian toads. In shape of parotoids it suggests *B. marmoreus* of México. The inclusion of this species in the synonymy of *B. typhonius* is entirely unjustified.

Specimens examined

BRAZIL: BM (type of *Bvfo ocellatus*), Parzudaki.
Minas Gerais: Januária, USNM 121334, IB 398, Instituto Butantan.

Bufo paracnemis A. Lutz

Figure 2

1925. *Bufo paracnemis* A. Lutz, 1925b, p. 213 (type locality, Bello Horizonte, Minas Gerais); 1926a, pp. 9, 15; 1934, pp. 114, 139, pl. 13 (lower part), pl. 14 (lower part), pls. 15–18, pl. 26, fig. 1.—Brazil and Vellard, 1926,p. 23, pls. 5, 6.— Serie, 1935b, p. 510; 1936, pp. 214–218, fig. 37, pl. 11.—Mello-Leitão, 1937, pp. 303, 315.—Freiberg, 1942, p. 223.—Travassos and Freitas, 1942, p. 282.

1936. *Bufo marinus paracnemis* Müller and Hellmich, p. 14, fig. 4, pl. 5.—Rengel, 1948, pp. 279–282.

Description.—Redescription of adult male, USNM 97238 (cotype), Bello Horizonte, Minas Gerais. Tongue elongate, spatulate, over one-third the width of mouth-opening, entire and free for most of its length behind; snout short, broadly rounded from above, truncate in profile, the upper jaw scarcely extending beyond lower; nostrils nearly at tip of snout and well below canthus, with the opening directed upwards and backwards, separated from each other by an interval equal to their distance from eye. Canthus rostralis marked by a short, heavy ridge forking in front of eye as a preocular crest, the main part continuing above the eye and abruptly turning at right angles to form a postocular crest, again forking above the ear and running into the heavy elongate parotoids, which are

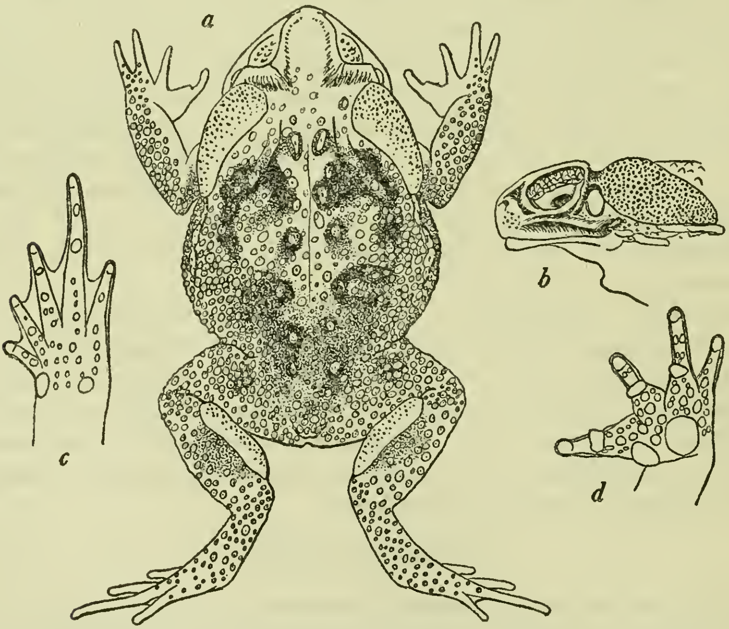


Figure 2.—*Bufo paracnemis*, USNM 97238 (cotype): *a*, Dorsum × ⅓; *b*, profile × ⅓; *c*, foot × ½; *d*, hand × ½.

twice as long as broad and taper posteriorly, their tips extending well beyond the axilla; parietal crests indistinct; a heavy curved ridge along the upper lip; interocular space smooth, flat, much below the level of the ridges. Eye moderate, not projecting beyond the heavy crests surrounding it, its diameter equal to three-fourths its distance from end of snout; interorbital diameter twice the width of upper eyelid, nearly twice the interval between the nostrils. Tympanum rather small, distinct, higher than wide, its vertical diameter nearly two-thirds the width of eye, separated from eye by a space equal to half its own diameter, including the postocular ridge. Fingers free, distinctly fringed, first much longer than second, which is shorter than fourth; no pronounced pollex, but a wart at base of first finger and a larger one on palm of hand; subarticular tubercles well developed, the basal ones single and quite large, the others double and smaller; toes one-third webbed, fringed, third longer than fifth, reaching slightly beyond base of antepenultimate phalanx of third; a prominent oval inner and a much weaker outer metatarsal tubercle; subarticular tubercles like those of the fingers; a very sharp inner tarsal ridge fading out halfway to heel. Body stout, in postaxillary region 1⅓ times the greatest width of head; when hind leg is adpressed, heel reaches to axilla; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels fail to meet. Skin of dorsum rough with large and small warts mostly tipped with small black spines, the central area of the back fairly smooth, with the large warts arranged in an irregular row on each side of the faintly indented midline, the warts on the sides and limbs small, fairly uniform in size and closer together, some of these forming a partial lateral row behind each parotoid; upper eyelid set with many conical sharp spines; a pair of heavy)(-shaped scapular ridges standing out from the plane surface behind the head; a very heavy gland along the top of the tibia extending from just behind the knee almost to the heel, deeply pitted like parotoids; ventral surface covered almost uniformly with polygonal granules, each of which has a central black spiny point; lower surface of tibia nearly smooth. No skinfold across the chest. Apparently a very slight external vocal sac, indicated by a transverse fold across the throat; thumb of male with a heavy black area in the breeding season.

Dimensions.—Head and body 170 mm.; head length 43 mm., width 66 mm.; femur 64 mm.; tibia 61 mm.; foot 58 mm.; hand 40 mm.

Color in alcohol.—Ground color above sepia, with an irregular seal-brown spot on each side of the back near the ends of the scapular ridges; a pair of smaller)(-shaped spots at the beginning of the lumbar region, and a few less distinct paired spots behind the parotoids and along the dorsolateral region and usually coloring the base of the large warts bordering the middorsal area; ventral region buff, with very faint gray spots evenly distributed over breast, belly and lower surfaces of limbs, the buff tone extending well up on the sides (where it is mottled with the dorsal color), edging the lower border of the parotoids, and extending nearly to the upper surface of the limbs; posterior femur slightly mottled with pale sepia over the buff color; all the warts and granules with black or clove-brown centers; parotoid and femoral glands dark sepia; tips of fingers and toes, and subarticular, metacarpal, and metatarsal tubercles clove brown; tarsal ridge and upper lip border also edged with this color; throat walnut brown, immaculate.

Variations.—Another cotype, USNM 97239, a female measuring 180 mm., agrees well with the male in structural features, except that the tibial glands are less swollen and the parietal crests are somewhat better developed. The black pigmentation is entirely lacking on the tips of the digits and on the tubercles of hands and feet, while the skin is much less rough and the small black spines are lacking, these being evidently sexual developments. The dorsum is mottled with large irregular dull brown spots on a drab ground. The throat, chest, and belly are cream buff, with only the faintest indications of gray spots, but posteriorly, especially on the legs, these spots become darker and much closer together. As in USNM 97238, the scapular ridges are pronounced and the parotoids taper to a blunt point posteriorly.

In 58 specimens variation in the length of the parotoid gland was found to range from 20 to 33 percent of the total length, averaging 25 percent. In about three-fourths of the individuals a more or less regular row of enlarged warts continued down the sides from the posterior ends of the always tapering glands; in the remainder of the specimens such rows were lacking or appeared partially on one side only. Distinct scapular ridges were found in nearly all the specimens, being lacking in but four. The tibial gland was large and well developed in both sexes, failing to appear only twice in the entire series at hand. The dorsum was often without any pattern in adult males, but usually in females there was a dark scapular spot and a few other smaller ones along each side of the back. The venter was usually spotted, although sometimes very pale, while in only one case was a reticulated pattern found.

Remarks.—This giant toad, common in Minas Gerais, Bahia, and Pernambuco, occupies the territory between *Bufo marinus* in the north and *B. ictericus* in the southeast, while both *B. ictericus* and *B. paracnemis* occur without intergrades in Rio de Janeiro and São Paulo, proving the correctness of their being considered distinct species. In the Gran Chaco region to the southwest, *paracnemis* is the only giant toad, and there, according to Müller and Hellmich (1936, p. 14), it reaches the truly amazing length of 205 mm. Thus its range encircles and partly overlaps that of *ictericus*, which seems to be confined to the coastal states of Rio de Janeiro and São Paulo, where *paracnemis* is very rare.

The species *paracnemis* is most easily recognized by its heavy tibial glands, more prominent than those of *B. alvarius* of Arizona and California, though lacking the glands along the forearm found in *alvarius*. The presence of pronounced scapular ridges in most individuals is a character useful in distinguishing *paracnemis* from *ictericus*, which seldom has anything more than a slight elevation between the parotoids. The tapering parotoids of *paracnemis* are at once obviously different from the broadly elliptical ones of *ictericus*, while the much more distinct dorsal pattern of the latter, especially in females, and its coarsely reticulated ventral region, give a decided contrast to the dull-spotted or unicolor back and the pale or spotted venter of the former. From *marinus* of the Amazon region, *paracnemis* can be separated by its longer and narrower parotoids and particularly by its tibial gland. It appears to be rather closely related to *B. arenarum*, of Argentine and Uruguay, which has tapering parotoids and very heavy scapular ridges. The latter, however, is a smaller species, the parotoids are much smaller in relation to the total length, and the tibia lacks the prominent swollen gland of *paracnemis*.

The collector J. Venancio believes that individuals may travel for great distances, as he found them several kilometers from the nearest water on top of the serra in arid fields where they were eating beetles at night. When distrubed, they deflated with a hiss like that of the cascavel, or *Crotalus terrificus*.

The voice is a very high *poo-poo-poo-poo-poo-poo*. Its native name in the north of Brazil is sapo cururu. The eggs are not known, but a series of fully metamorphosed young, USNM 98838, were taken at Casa Nova, Bahia, on April 16, 1935. They measure about 12 mm. in total length, and the elongate parotoid can already be plainly seen, followed by a conspicuous lateral fold that in the adult is sometimes represented only by a row of warts. These young have the pattern of the typical adult female, several more or less rectangular dark spots in a row on either side of the midline.

Specimens examined

BRAZIL:

BAHIA: Bom Jardim, USNM 98822, Dias, Apr. 13, 1935.
Casa Nova, USNM 98838, Dias, Apr. 16, 1935. Rio Itapicurú, Queimadas, CM 2680, Hasemen, Mar. 2, 1908. Sarubahyba, USNM 98827, Dias, Apr. 14, 1935.

MINAS GERAIS: Bello Horizonte, USNM 97238–9 (♂ and ♀, cotypes of *Bufo paracnemis*), A. Lutz, 1923. Januária, USNM 98812–3, Dias, Apr. 11, 1935. Lagôa Santa, USNM 97978–81, Cochran, Lisboa, and Dias, Mar. 19, 1935; UZMK 90, Reinhardt. Lassance, USNM 98086–9, Cochran, Dias, and Venancio, Mar. 25–26, 1935. Pirapora, USNM 101140, Cochran, Dias, and Venancio, Mar. 22–23, 1935. Rio das Velhas, BM 1926.3.16.9, Chalmers. São Francisco, USNM 98806, Dias, Apr. 18, 1935.

PERNAMBUCO: USNM 57598, Hurter, December 1895.

RIO DE JANEIRO: Guapi near Teresópolis, USNM 97656 and 97660, Sandig, May 1935.

SÃO PAULO: Emas, DZSP 2963–4, Vanzolini and Bokermann, December 1947. Fazenda Schmidt near Ribeirão Preto on the Mogyana Railway, USNM 100969, Worontzow, Apr. 4–10, 1935.

Bufo rufus Garman

FIGURE 3

1876. *Bufo rufus* GARMAN, p. 413 (type locality, Goiás).—BARBOUR and LOVERIDGE, 1929, p. 233.—A. LUTZ, 1934, pp. 121, 146, pl. 21, pl. 27, fig. 4.

1925. *Bufo rubescens* A. LUTZ, 1925b, p. 214 (type locality, Bello Horizonte, Minas Gerais); 1926a, pp. 9, 16 (lapsus, p. 16, *rubens*); 1934, pp. 122, 148, pl. 21.

1926. *Bufo rufescens* (sic) BRAZIL and VELLARD, p. 23.

Description.—Redescription of adult female, USNM 97236 (cotype of *Bufo rubescens*), Bello Horizonte, Minas Gerais. Tongue elongate, spatulate, over one-third the width of mouth-opening, free behind; snout short, rounded when seen from above, nearly truncate in profile, the upper jaw scarcely extending beyond lower; nostrils midway between eye and tip of snout, slitlike, diagonal, opening superiorly, separated from each other by an interval considerably greater than their distance from eye. Canthus rostralis marked by a short, heavy ridge that joins a prominent preocular crest standing out distinctly beyond the flat, oblique loreal region, making the latter appear sunken; canthal ridge continuous with the raised supraorbital crest curving outward behind the eye and almost immediately merging with the heavy elongate parotoids which extend beyond the axillae; a blunt low postocular crest bordering the tympanum; parietal crests indistinct, suggested only by a slight roughness in that region; a slight ridge along the upper lip; interocular space smooth and very deeply concave. Eye large and prominent, a little longer than its distance from end of snout; interorbital diameter 1⅔ times the width of the upper eyelid, much greater than interval between nostrils. Tympanum moderate, distinct, higher than wide, its vertical diameter two-thirds the width of eye, separated from eye only by the postocular ridge. Fingers free but distinctly fringed, not dilated, first slightly shorter than second, which is shorter than fourth; no pronounced pollex, but an oval wart on base of first finger and a much larger one on palm; subarticular tubercles of fingers small, except those of the basal phalanx, which are very large; toes half webbed, fringed to the tips which are not dilated, third toe longer than fifth and reaching halfway on antepenultimate phalanx of fourth; a prominent small hemispherical inner and a flat oval outer metatarsal tubercle; subarticular tubercles of distal toe joints double, those of basal phalanx single and slightly enlarged; a distinct sharp inner tarsal ridge fading out before the heel is reached. Body stout, in postaxillary region nearly 1½ times the greatest width of head; when hind leg is adpressed, heel reaches to axilla; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels barely touch. Skin of dorsum with numerous large, very blunt warts mingled with smaller ones; a few small spinules on the supraocular ridges and on the warts of the tibia and tarsus; the parotoids deeply pitted; ventral surface coarsely and irregularly granulate, heavily so beneath the chin, very finely so on lower foot and tibia. No skinfold across the chest. (An external vocal sac in the male.)

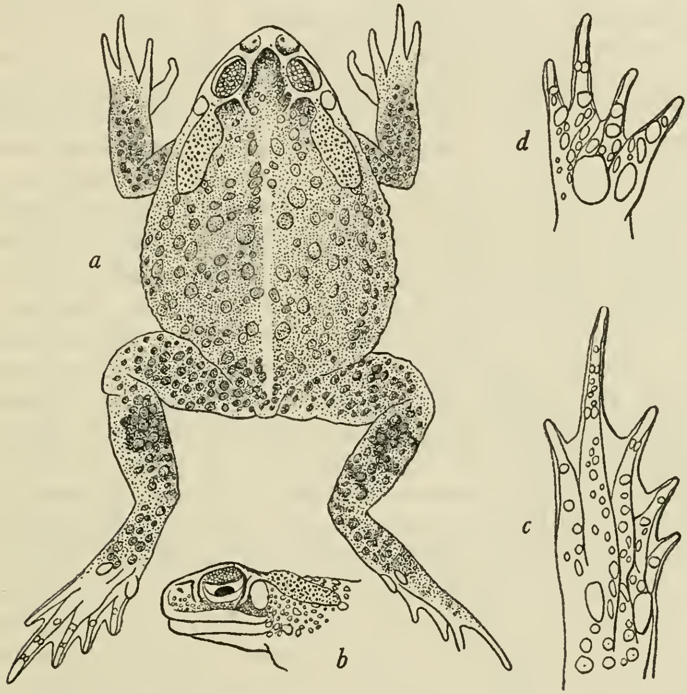


FIGURE 3.—*Bufo rufus*, USNM 97236: *a*, Dorsum × ½; *b*, profile × ½; *c*, foot × 1; *d*, hand × 1.

Dimensions.—Head and body 102 mm.; head length 28 mm., width 37 mm.; femur 42 mm.; tibia 40 mm.; length of parotoid gland 23 mm.; width 8 mm.; foot 43 mm.; hand 26 mm.

Color in alcohol.—The specimen is now dull wood brown to drab above, lightening to pale yellowish olive on the legs; venter dull straw yellow, immaculate except for some small gray dots on the posterior belly and some heavier gray reticulations on the lower posterior femur; the tips of the spinules on legs and supraocular crests are black.

Variations.—A second cotype of *B. rubescens*, USNM 97237, also a female, measures 117 mm. in total length. Its head is considerably more blunt, the snout being only about three-fourths the eye diameter. The ridge along the upper lip is somewhat larger and its color is decidedly darker and more mottled. Irregular dark crossbands appear on the legs, while a dull marbling of dusky brown and drab appears over the top and rear of femur, on the sides, and to a lesser extent on the forearm. Both females, taken in May, are greatly distended with eggs, showing that the egg laying extends well past the warm season. Two other half-grown specimens are at hand, and another labeled simply "Rio de Janeiro" probably referring to the State, not the city. Scapular ridges are distinct in all, and the shape of the parotoids is constantly a narrow ellipse pointing outwards posteriorly, not tapering (an appearance of tapering is sometimes caused by fusion of the first of the strong lateral series of warts present in every specimen). The inner border of the parotoids is either straight or very slightly concave, and the anterior half is not noticeably wider than the posterior. The venter is immaculate in three individuals: spots occur only posteriorly, on belly and femur, in two specimens. No sign of tibial glands is to be found, this species seeming to have less warty skin with fewer glands than do its neighbors *B. paracnemis* and *B. ictericus*. The largest specimen, a fully adult female, is 119 mm. long, as already noted, and it is probable that the maximum size of the species does not greatly exceed this figure. More specimens are needed, however, to get a true conception of the degree of variation. The males have the inner surface of the thumb black and roughened.

Remarks.—By its build and general appearance, *Bufo rufus* appears to be closer to *B. arenarum* Hensel than to any other toad occurring in southeastern South America. Both species have the postocular crest almost directly confluent with the parotoid, while in *B. ictericus*, *B. paracnemis*, and *B. marinus* a short longitudinal branch of the postocular crest makes a decided bridge across to the parotoid. *B. arenarum*, however, differs in the shape of its crests, which suggest those of *paracnemis*, the anterior part being much broader than the tapering posterior, whereas the inner border is very concave. Another difference is the extremely warty skin of *arenarum*, while *rufus* is one of the smoothest of Brazilian toads, suggesting *B. crucifer* in this respect.

Specimens examined

BRAZIL:

Minas Gerais: USNM 70605, Metcalf, Oct. 17, 1925. Bello Horizonte, USNM 97236–7 (cotypes of *Bufo rubescens*), A. Lutz, May 1925; USNM 96949, Feb. 1, 1929. Congonhas, ZSBS 35/1935 (3), Oser.

Rio de Janeiro; USNM 70606, Metcalf, Oct. 21, 1925.

***Bufo typhonius* (Linnaeus)**

Figure 4; Plate 4, Figures f, g

1758. *Rana typhonia* Linnaeus, p. 211 (type locality, America).—Gmelin, 1789, p. 1050.—Shaw, 1802, p. 159, pl. 45.

1768. *Rana margaritifera* Laurenti, p. 30 (type locality, Brazil).—Gmelin, 1789, p. 1050.

1799. *Bufo typhonius* Schneider, p. 207.—Merrem, 1820, p. 181.—Peters, 1873a, p. 226.—Boulenger, 1882a, p. 317, fig.; 1884a, p. 637; 1898a, p. 132; 1898b, p. 123; 1903a, p. 69; 1913, p. 1022.—Günther, 1901, p. 253.—Werner, 1901, p. 600.—Lidth de Jeude, 1904, p. 93.—Peracca, 1904b, p. 36.—Despax, 1911, p. 43.—Baumann, 1912, p. 97, fig. A; 1917, pp. 132, 143.—Fowler, 1913, p. 153.—Ruthven, 1919, p. 8.—Beebe, 1919, p. 207; 1925, p. 125.—Barbour and Noble, 1920, p. 425.—Procter, 1921, p. 191.—Nieden, 1923, p. 139.—Cott, 1926, p. 1159.—Brazil and Vellard, 1926, p. 23.—Parker, 1926b, p. 554; 1934b, p. 266; 1935, p. 509; 1938, p. 439.—A. Lutz, 1927, p. 40; 1934, pp. 130, 156.—Ahl, 1929, p. 149, photo.—deWitte, 1930a, p. 17.—Nicéforo-Maria, 1930, p. 104.—Crawford, 1931, p. 29.—Crawford and Jones, 1933, p. 88.—Müller and Hellmich, 1936, p. 20, fig. 6.—Hellmich, 1939, p. 537.—Andersson, 1939, p. 19; 1945, p. 61.—Mello-Leitão, 1937, p. 292.—Melin, 1941, p. 16.—Travassos and Freitas, 1942, p. 282.

1799. *Bufo nasutus* Schneider, p. 217 (type locality, Brazil).

1803. *Bufo margaritifer* Daudin, 1802, p. 89, pl. 33, fig. 1; 1803, p. 179.—Duméril and Bibron, 1841, p. 718.—Steindachner, 1867, p. 47.—Cope, 1874, p. 120; 1887, p. 45.

1824. *Oxyrhynchus naricus* Spix, p. 49, pl. 14, fig. 2 (type locality, Amazon River).

1824. *Oxrhynchus nasutus* Spix, p. 50, pl. 14, fig. 3.

1824. *Oxyrhynchus acutirostris* Spix, p. 52, pl. 21, fig. 3 (type locality, Amazon River).

1824. *Oxyrhynchus proboscideus* Spix, p. 53, pl. 21, fig. 4.—Espada, 1875, p. 178.

1824. *Oxyrhynchus spixii* Wied, 1824a, pl. [61], fig. 3 (type locality, Brazil).

1838. *Osilophus typhonius* Tschudi, p. 89.

1843. *Otolophus margaritifer* Fitzinger, p. 32.

1843. *Eurhina proboscideus* Fitzinger, p. 32.

1845. *Trachycara fusca* Tschudi, p. 78, pl. 11, fig. 5 (type locality, region of Ceja between Jauja and Uchubamba, Perú).—Peters, 1873b, p. 624.

1858. *Otilophus margaritifer* O. Schmidt, p. 251, pl. 2, figs. 15–16.—Gunther, 1858, p. 69; 1859, p. 89.—Cope, 1862b, p. 357.

1858. *Bufo pleuropterus* O. Schmidt, p. 252, pl. 2, figs. 17–19 (type locality, Bolivia to Perú).—Günther, 1858, p. 142.

1870. *Bufo margaritiferus* Cope, p. 156.
1871. *Otilophus typhonius* Peters, 1871a, p. 403.—Miranda-Ribeiro, 1926, p. 135, pl. 20, figs. 1–1b; 1929a, p. 67.—Carvalho, 1939a, p. 280.
1875. *Oxyrhynchus typhonius* Espada, p. 171.
1875. *Oxyrhynchus iserni* Espada, p. 185 (type locality, northeast of Tarma, Perú).
1896. *Bufo thyphonius* Peracca, p. 12; 1914, p. 108.
1933. *Bufo typhonius typhonius* Leavitt, p. 8.

Description.—Adult female, USNM 97711, Guapi, Teresópolis, Rio de Janeiro. Tongue elongate, spatulate, over one-third the width of mouth-opening, free behind; snout short, truncate at the tip when viewed from above and in profile, the upper jaw extending considerably beyond lower; nostrils projecting, about one-third as far from tip of snout as from eye, horizontal, superolateral, separated from each other by an interval a little less than their distance from eye. Canthus rostralis distinct and very concave, giving the end of the snout a curiously pinched appearance; loreal region vertical, nearly flat to upper lip border; a thin, sharp supraocular crest ending in a heavy, raised, jutting bony ridge above tympanum and practically obscuring the small, triangular parotoid; a distinct parietal crest from center of supraocular crest, converging, ending behind the eye on the occiput; eye large and prominent, its diameter equal to its distance from end of snout; interorbital region flat, with the supraocular crests rising above it, twice the width of the upper eyelid at its narrowest (anterior) part. Tympanum moderately large, its greatest diameter equal to two-thirds that of eye, separated from eye only by a slight postocular ridge; a bony triangular projection on corner of upper jaw directly below tympanum. Parotoids merging with the immensely developed supratympanic crest, small, diverging posteriorly above the shoulders; a single row of pronounced conical tubercles beginning on the parotoid and continuing along a heavy lateral skin fold to the groin. Fingers slightly webbed, with lateral ridges, their tips not dilated, fourth longer than second, reaching halfway on antepenultimate phalanx of third; no pollex; an oval tubercle on base of first finger, and a flat round palmar tubercle; subarticular tubercles well developed, single, except below base of penultimate phalanx of third finger, where they are double; toes one-third webbed, fringed, their tips not dilated, third a trifle longer than fifth, reaching to base of antepenultimate phalanx of fourth; a small oval metatarsal tubercle and a smaller round outer one; subarticular tubercles of toes well developed, all single; a fairly regular row of tubercles marking the outer tarsal border. Body stout, in postaxillary region slightly greater than width of head measured between tympani; when hind leg is adpressed, heel reaches to center of tympanum; when limbs are laid along the body, knee and elbow touch; when hind legs are bent at right angles to body, heels are separated slightly. Dorsal skin minutely granular, with a middorsal row of larger tubercles from occiput almost to sacrum and a few scattered tubercles on snout and between the eyes, although the skin of the entire top of head appears to be ossified with the skull; the tuberculate lateral fold already mentioned ends in a loose inguinal membrane suggesting the similarly formed axillary wing of the *Hyla marmorata* group; upper femur and tibia with larger tubercles; venter finely granular on chin, coarsely so on belly and lower femur. (A median external vocal pouch in the male.)

Dimensions.—Head and body 48 mm.; head length 15 mm., width 18 mm.; femur 20 mm.; tibia 21 mm.; foot 17 mm.; hand 13 mm.

Color in alcohol.—Dorsum wood brown, with a dark, narrow middorsal line and some dark spots irregularly scattered on upper limb surfaces and dorsolateral region; two faint, dark brown bars across upper femur, tibia, and foot, and a very dark bar nearly encircling the forearm; side of head buff, with a dark bar below eye; venter buff, with darker mottlings on throat and chest.

Remarks.—This species has long been known from as far south as Bahia, since the Cope collection contained several examples (ANS 2301–4) from there. The Museu Paulista, Buenos Aires, has additional Bahian examples and one from Goiás, while the Musée Royale d'Histoire Naturelle, Brussels, has one from Alto da Serra, São Paulo. It is not surprising therefore to find the species well represented at Teresópolis in the State of Rio de Janeiro, and further careful collecting will undoubtedly discover it in Minas Gerais. Müller and Hellmich (1936, p. 20) report examples from the Chaco region in Argentina as well as from Bolivia.

A discussion of the status of *B. alatus* Thominot and other forms outside the region covered here must await the assembling of more material.

In a comparison of the Teresópolis specimens with a series from Salto da Huá, on Rio Maturaca on the Brazilian-Venezuelan boundary, the subarticular tubercles on the toes of the former seemed very much smaller than those of the latter; and on other examples of *typhonius* from Ecuador and Panamá the tubercles are found to vary greatly in size, so that no basis for subspecific separation seems to be indicated by these local variations.

Occasionally one of the half-grown toads is vinaceous to light burnt carmine above, the contrast between this and the usual brown-and-yellow coloration being very striking indeed. The color pattern is extremely variable, some individuals having a pale dorsolateral line, some a pattern of large or small dorsal spots somewhat suggesting those of certain examples of *Bufo crucifer*, and many are without any dorsal markings at all. A young toad from Bahia, USNM 102313, has two large white triangles extending inwards from the parotoids, their apices nearly meeting on the occiput and their bases continued onto the upper eyelid and along the dorsolateral line to the groin; the remainder of the dorsal surface is rich burnt umber, with a pair of irregular white concentric markings just anterior to the sacral hump. A less accentuated but similar style of coloration is seen in one or two of the Teresópolis frogs, as well as in a young one from Rio Canaburi in Amazonas, USNM 83548, and in several from Panamá. The ventral region may be pale, or spotted with brown or almost entirely brown with minute brilliant yellow dots on the throat. The largest Teresópolis specimen, USNM 97711, is 49 mm. long; one from Salto da Huá, USNM 83571, exceeds it by 4 mm., but an example from Ecuador measures 78 mm.

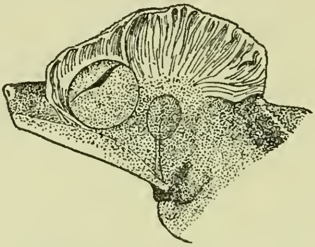


Figure 4.—*Bufo typhonius,* USNM 108987, from Maroni River, British Guiana, showing extreme development of head crests; × 1.

The usual well-marked black thumb of the male, a valid secondary sexual character in most species of *Bufo,* is of no value in determining sex in this species, since black spots on the joints of the thumb occur as part of the color pattern of nearly all specimens. The thumb joint does not seem to become swollen at breeding season in males on *typhonius,* hence internal dissection must be resorted to, except of egg-bearing females, in order to ascertain the sex.

An enormous development of the supratympanic crests occurs in USNM 108987 from British Guiana. The parotoids are completely overgrown by the crests, which double the normal height of the head.

Specimens examined

BRAZIL:

Amazonas: Cachoeira Panela de Onça, USNM 83548, Holt, Nov. 1, 1930. Hyutanahã, USNM 28938–9, Steere. Manáos, NMS, —, Triebel. Rio Canaburi below mouth of Rio Maturaca, USNM 83549, Holt, Nov. 6, 1930. Salto da Huá, USNM 83552–3, 83555, 83559–60, 83571, and 83577, Holt, November–December, 1930. São Antonio de Rio Madeira, CM 2611, Haseman, Nov. 2, 1908.

Bahia: Bahia (?), AMNH 38556, Beck, 1914;
Itaeté, MRHN IG 9308, Reg. 37b, Massart, December 1922
Serra do Palhão, USNM 102313 and MP 2041.

Goiás: Jaraguá, MP 2028, September 1934.

Rio de Janeiro: Colomi near Teresópolis, USNM 97729, Sandig, Apr. 10, 1935. Guapi near Teresópolis, USNM 97710–6, Sandig, March–April 1935; NMS (2), P. Giesler.

São Paulo: Alto da Serra, MRHN IG 9308 Reg. 37, Massart, September 1922.

BOLIVIA: Guajará-Mirim, USNM 123963, Gilmore. Río Guaporé, CM 2510, Haseman, July 18, 1909.

BRITISH GUIANA: Kartabo, NYZS 2919–20, 3001, 3066, 3074, 3087 and 3192, Beebe. Maroni River, USNM 108987, Mjoberg.

COLOMBIA: Alto Río Waupes, AMNH 514. Darién, USNM 4337, Schott. Isthmus of Darién, MRHN IG 4544 Reg. 37g. La Esperanza, MRHN IG 12175. Quebrada Santa Ana, USNM 124266, Brady. Regeneración, USNM 127856–62, Carriker.

ECUADOR: Andoas, Río Pastaza, MRHN IG 11698, Olalla, Oct. 5–9, 1934. Macas, El Oriente, USNM 101827–30, Madeira, December 1922. Mirador, AMNH 38518, 38523, 38526, 38528, Tate, February 1924. Plaza de Oro, USNM 20593–7, M. B. Kerr, January–February 1893.

PERÚ: Orellana, near Campo Santa Clara, USNM 127144–6, 127149–56, 127934–6, Rozanski. Río Huacamayo, MRHN IG Reg. 31g.

VENEZUELA: Cerro Yapacana, USNM 83949, Holt, Apr. 24, 1931. El Limón, D. F., USNM 121173–4, Boswell.

Family CENTROLENIDAE

This group of frogs, for the most part of diminutive size, may be characterized as follows: Ultimate phalanges T-shaped, with an intercalated cartilage between the penultimate and the ultimate phalanges; sacral diapophyses more or less broadly expanded; the astragalus and calcaneum fused into a single slender bone; pectoral girdle arciferal; coccyx articulating by a double condyle; eight procoelous, presacral vertebrae; no omosternum.

Many of the species of this family are known in life to be green on the dorsal and exposed surfaces. On the ventral and concealed surfaces they are often transparent flesh color or sometimes yellowish or whitish. In preservation they are no longer transparent, the green color is lost, and pigment is present in large or small chromatophores, lavender or purplish in color and more or less equally distributed. Occasionally the dorsum is decorated with small deep purple punctations, or with small rounded white or cream spots. The lavender or purple pigments are probably not visible in life; the cream marks may appear on the green background of the living frogs.

The known range of this family extends from the States of Veracruz and Guerrero in México to southeastern Brazil.

The fact that numerous related species having the above characters form a group worthy of family rank was noted by Dr. Edward H. Taylor (1951) in his study of the Costa Rican amphibians. He has likewise proposed the generic name *Cochranella* for species formerly placed in the genus *Centrolenella,* that lack the humeral process or "hook" in the males.

Since Dr. Taylor wished to extend his studies of this peculiar assemblage of species beyond the limits of Central America, it has been decided to treat the southern Brazilian forms separately. Further details of this group, with descriptions of several new forms, are covered in a paper by Taylor and Cochran (1953).

Family HYLIDAE

Procoela with the two halves of the pectoral girdle overlapping on the midline and movable; an intercalary cartilage or bone present before the terminal phalanx of the digits; astragalus and calcaneum not fused.

The careful work of Parker (1931, 1935) has indicated that *Pseudis* deserves to be ranked as a separate subfamily of the Hylidae because of its foot structure. The two subfamilies are separated by the following key:

a^1. Additional intercalary phalanx shorter than the terminal one . . **Hylinae**
a^2. Additional intercalary phalanx longer than the terminal one . . **Pseudinae**

Aplastodiscus perviridis A. Lutz (*in* B. Lutz, 1950, p. 612; type locality, Serra da Bocaina) is as yet unknown in collections outside Rio de Janeiro. It is not included, therefore, in the present discussion.

Subfamily HYLINAE

Key to the genera of Hylinae of southeastern Brazil

a^1. A dorsal skin pouch for incubating eggs in female.
  b^1. Pouch opening by a small supra-anal orifice . . . . **Gastrotheca** (p. 49)
  b^2. Pouch with a large longitudinal opening.
   c^1. Skin of head ossified with skull . . . . **Flectonotus** (see below)
   c^2. Skin of head free from skull . . . . **Nototheca** (p. 194)
a^2. No true dermal pouch for incubating eggs in female.
  b^1. Inner finger and toe opposable to other digits . . **Phyllomedusa** (p. 195)
  b^2. Inner finger and toe not opposable.
   c^1. Parasphenoid bones toothed . . . . **Amphodus** (p. 45)
   c^2. No parasphenoid teeth.
    d^1. Skin of head free from skull . . . . **Hyla** (p. 54)
    d^2. Head a bony casque, with skin and skull ossified.
     e^1. Head not elongate; eye nearly as long as snout. **Trachycephalus** (p. 207)
     e^2. Head elongate: eye ½ length of snout . . **Aparasphenodon** (p. 45)

The type of *Flectonotus ulei* Miranda-Ribeiro (1926, p. 109, fig. 64; type locality, Nova Friburgo, Rio de Janeiro) was compared with *Nototheca fissilis* by Bokermann (1950, p. 217). They were found to differ in the attachment of the head skin, which in *Flectonotus* is fast to the skull and in *Nototheca* is free. As I have not seen an example of the former, no discussion of it is given here.

Genus *Amphodus* Peters

1872. *Amphodus* PETERS, 1872b, p. 768. (Genotype, *Amphodus wuchereri* Peters.)
1923. *Lophyohyla* MIRANDA-RIBEIRO, 1923e, p. 5; 1937b, p. 26.—Noble, 1926a, p. 17.

Generic diagnosis.—Pupil horizontal. Tongue heart-shaped, slightly free behind. Teeth on the palatine bone and on the parasphenoid. Tympanum distinct. Fingers free; toes nearly free, the tips dilated into well-developed disks. Outer metatarsals united. Omosternum present.

Amphodus piperatus (Miranda-Ribeiro)

PLATE 4, FIGURES H–K

1923. *Lophiohyla* (sic) *piperata* MIRANDA-RIBEIRO, 1923e, p. 5 (type locality, [Quinta da Bos Vista], city of Rio de Janeiro); 1926, pp. 65, 202, pl. 7, figs. 1, 1,a–d; 1937, p. 55.—BARBOUR and LOVERIDGE, 1929, p. 298.—SCHUBART, 1939, p. 51.
1946. *Amphodus piperatus* MYERS, pp. 11, 29.

Description.—A translation of the original description of this rare species follows:

> Outline of head circular; nostrils contiguous; eyes large, as long as the snout; tympanum equal to diameter of eye. Maxillary teeth isolated, but subequal and regularly distributed; mandibular teeth as in *Amphodus wuchereri*. When hind leg is adpressed, heel reaches slightly beyond tip of snout. Fingers free; toes webbed at the base. Color: yellowish red finely dotted with chocolate brown. Eyes black; the border of eyelid black; abdomen with white star-shaped markings. Body, 22 mm.; leg and foot, 32 mm. Four examples probably from Rio de Janeiro.

Remarks.—Regarding the type locality, Myers (1946) says, "the types were collected by Eduardo de Siqueira many years ago in the Quinta da Boa Vista, near the Museu Nacional. The species certainly no longer exists there."

Genus *Aparasphenodon* Miranda-Ribeiro

1920. *Aparasphenodon* MIRANDA-RIBEIRO, 1920a, p. 87. (Genotype, *Aparasphenodon brunoi* Miranda-Ribeiro.)

Generic diagnosis.—A translation of the generic diagnosis follows:

> General form as in *Diaglena*, with the cranium in the same plane as the body; pupil horizontally oblong; eyelids as in *Triprion;* tongue escutiform, adnate, notched and free posteriorly. Nostrils exterior to the canthus rostralis. Hands and feet half webbed. Fingers and toes provided with disks and with the last

phalanx crooked. Vomerine and palatine teeth as in *Diaglena;* these are firm and not cutaneous.

Aparasphenodon brunoi Miranda-Ribeiro

FIGURE 5; PLATE 5, FIGURES A, B

1920. *Aparasphenodon brunoi* MIRANDA-RIBEIRO, 1920a, p. 88, pl. [1] (type locality, Rio de Janeiro); 1926, p. 98, fig. 57, pl. 12, figs. 1–1,b; 1939, p. 25.—DEWITTE, 1930a, p. 228.—MERTENS, 1926c, p. 137.—CARVALHO, 1939b, p. 25; 1941, p. 101.—MYERS, 1946, pp. 14, 31.

1920. *Corythomantis apicalis* MIRANDA-RIBEIRO, 1920a, p. 89, pl. [2] (type locality, Espírito Santo).—MERTENS, 1926c, p. 139.

1925. *Corythomantis adspersa,* A. LUTZ, 1925b, p. 213 (type locality, Niterói, Rio de Janeiro); 1926a, pp. 8, 15.—MERTENS, 1926c, p. 139.—LUTZ and LUTZ, 1939b, p. 251.

1926. *Aparasphenodon apicalis* MIRANDA-RIBEIRO, p. 99, fig. 58, pl. 12, figs. 2–2,b.

1926. *Corythomantis brunoi* MERTENS, 1926c, p. 139.

Description.—Adult male, USNM 96413 (cotype of *Corythomantis adspersa*), Lagôa de Saguarema (Nilo Teçanha), Rio de Janeiro. Vomerine teeth in two well-separated, exceedingly heavy triangular patches between the very large choanae; palatine teeth present, well developed; no parasphenoid teeth; tongue three-fourths the width of mouth-opening, nearly round, without a notch on its attached posterior border; top of head osseous; snout long, with a heavy projecting bony ridge extending along the upper lip and another along the canthus rostralis, merging at the tip; top of head and area between these ridges deeply concave; in profile the snout slopes almost horizontally forwards to the blunt bony tip, so that the upper jaw projects

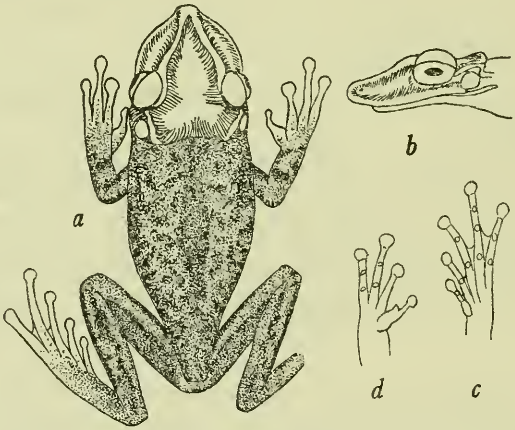


FIGURE 5.—*Aparasphenodon brunoi,* USNM 96413: *a,* Dorsum; *b,* profile; *c,* foot; *d,* hand; all × ⅔.

greatly beyond the lower; nostrils lateral, not projecting from their bony surroundings, their distance from end of snout about one-fourth that to eye, separated from each other by an interval equal to two-fifths their distance from eye. Loreal region above vertical, below flaring outwards. Eye large, very prominent and bulging, its diameter slightly over one-half its distance from end of snout; pupil diamond shaped (in this specimen); interorbital diameter nearly three times that of upper eyelid, more than three times the distance between nostrils. Tympanum very distinct, its greatest (vertical) width almost one-half the eye diameter, separated from eye by an interval equal to more than one-half its own diameter. Fingers scarcely webbed even at the base, fourth considerably longer than second, reaching to base of disk of third, which covers two-thirds the tympanic area; no apparent dermal ridges along inner or outer forearm; a rudiment of a pollex showing as a blunt semicircular projection at base of first finger; toes one-fourth webbed, third and fifth subequal, disk of fourth covering about one-half the tympanic area; a long blunt inner and a very minute outer metatarsal tubercle; distinct subarticular tubercles present on hands and feet; no apparent dermal ridges on tarsus or heel. Body elongate and heavily built, in postaxillary region almost as wide as greatest width of head; when hind leg is adpressed, heel reaches to anterior border of eye; when limbs are laid along the body, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels overlap very slightly. Head smooth except for the labial and canthal ridges, a wide occipital ridge terminating behind the eye, and a short ridge bordering the upper part of ear; skin of back and upper limb surfaces quite smooth; skin of throat, chest, and sides of body fairly smooth, that of belly and lower part of femur granular. No skinfold across the chest; a pair of prominent lateral vocal sacs. (The right hind foot in this specimen is missing.)

Dimensions.—Head and body 75 mm.; head length 27 mm., width 22 mm.; femur 28 mm.; tibia 30.5 mm.; foot 25 mm.; hand 19.5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	5	5	4	5	4	4
Mean	36. 5	30. 2	36. 8	40. 3	34. 5	26. 4
Standard deviation	. 89	. 52	. 34	. 39	1. 08	. 65
Variation	2. 4	1. 7	. 92	. 97	3. 2	2. 5
Standard error	. 40	. 23	. 17	. 17	. 54	. 32
Range	35. 9– 37. 7	29. 3– 30. 7	36. 4– 37. 3	40. 0– 41. 0	32. 9– 34. 1	25. 9– 27. 5

Color in alcohol.—The specimen has bleached to pale pinkish buff above, turning to ochraceous on the head and on the lower surfaces. In the axilla and groin are still traces of a richer cinnamon brown.

Color in life.—From an unsigned sketch of the described specimen. Dorsal ground color burnt umber to chocolate, the bony ridges on head lighter and more metallic; numerous coarse black spots along the sides, a few in the midlumbar region, some smaller ones along outside of forearm and tibia; a black oblong spot on top of head between eyes and an irregular dark spot behind each nostril; wrist and upper part of finger disks dark seal brown; tarsus and toes similar but lighter; iris raw umber, the pupil diamond shaped and black; chin dull raw umber.

In life, one specimen, USNM 97640, was metallic gold above, with a deep chocolate stripe on top of the head and another down the center of the back. In alcohol, this specimen has now become burnt umber, with scarcely a trace of the once-contrasting chocolate marking.

Variations.—The largest known frog of this species measures 85 mm. in head and body length. While the teeth in all listed specimens are identical with those of the one described, the tongue in two frogs is considerably less than three-fourths as wide as the mouth-opening, almost circular, and with a very slight notch on its nearly attached posterior border. The critical measurements are very stable in the five specimens at hand, although there is considerable variation in the size of finger disks and toe disks. The extended hind leg has the heel reaching to either the anterior or posterior border of the eye. The skin on the sides of the body is smooth or very minutely glandular in all cases. A very distinct pattern of coarse, reticulating blotches is to be seen on the back of USNM 97639, while on the lower part of its sides the blotches are further set off by pale gray interstices. A light gray stripe runs along the upper part of the femur, with its anterior and posterior surfaces dark colored, while some irregular dark blotches take the place of crossbands on the light upper part of tibia and tarsus as well as on the forearm. The throat is dark in this example, and heavy folds of dark skin at each side of the throat give additional evidence of the presence of a pair of external vocal sacs in the male. A large heart-shaped callosity is present on the much swollen proximal phalanx of the first finger. The longitudinal dark spot between the eyes, apparently characteristic of the species, is especially prominent in this specimen.

Remarks.—This species does not appear to be synonymous with Boulenger's *Corythomantis greeningi* from "Brazil." The toes of *brunoi* have shorter webs; the sides of the body in *brunoi* are nearly smooth, whereas closely set tubercles are said by Boulenger (Ann. Mag. Nat. Hist., ser. 6, vol. 17, p. 405, 1896) to be present there in *greeningi*, and the head of *brunoi* is appreciably longer than wide (116 to 126 percent in 5 examples, averaging 121 percent), whereas these dimensions appear to be the same in the figure of *greeningi*.

Records for this species are so far confined to the States of Rio de Janeiro and Espírito Santo. No eggs or young have as yet been found. Its cry is an *ah, ah, ah,* grunting like a pig rather slowly. The adults sleep in the daytime in bromeliads and bamboo, and at night seek the water.

Although the original description of *C. adspersa* lists "Un exemplaire de Nitheroy," two examples were in Dr. Lutz's possession at the time the description was written. The second cotype, now in the Instituto Oswaldo Cruz, is from Sacco São Francisco, on the outskirts of Niterói, and is said to have been collected by Vellard in 1924. Its head and body measurement is 70 mm. It is in good condition except on one side, but the color has entirely faded out.

Specimens examined

BRAZIL:

Districto Federal: Barra do Tijuca, MRHN IG 9308 Reg. 44, Massart, Sept. 11, 1922. Recreio dos Bandeirantes, USNM 97576, Campos, Feb. 18–25, 1935; MHNP 8158 (1), Brazil.

Rio de Janeiro: Lagôa de Saguarema (Nilo Teçanha), near Niterói, USNM 96413 (cotype of *Corythomantis adspersa*), May 29, 1934. Sacco São Francisco, near Niterói, USNM 97639, Venancio, Feb. 9, 1935; USNM 97640–1, Cochran, Feb. 14, 1935 (taken in bromeliads).

Genus *Gastrotheca* Fitzinger

1843. *Gastrotheca* Fitzinger, p. 30. (Genotype, *Hyla marsupiata* Duméril and Bibron.)

Generic diagnosis.—Pupil horizontal. Tongue subcircular, entire or slightly nicked, slightly free behind. Vomerine teeth present. Tympanum more or less distinct. Fingers webbed at base; toes webbed, the tips dilated into regular disks. Outer metatarsals united. Female with a dorsal pouch. Omosternum cartilaginous; sternum a cartilaginous plate. Diapophyses of sacral vertebra moderately dilated.

Key to species of Gastrotheca of southeastern Brazil

a^1. Heel reaching to end of snout; skin granular on the back; body usually dark-spotted . . . . **microdisca** (p. 50)
a^2. Heel reaching to eye; skin smooth; sides of body and limbs with a dark fringed pattern.
  b^1. Vomerine teeth contiguous; ground color brown in life . . **ernestoi** (p. 50)
  b^2. Vomerine teeth well separated; ground color green . . . . **viridis** (p. 52)

Gastrotheca ernestoi Miranda-Ribeiro

1920. *Gastrotheca ernestoi* Miranda-Ribeiro, 1920g, p. 323 (type locality, Macaé, Rio de Janeiro); 1926, pp. 111, 211, fig. 65.—L. Müller, 1938, p. 286.

Description.—A translation of the original description follows:

Snout rounded, its tip perfectly vertical in profile. Canthus rostralis distinct. Nostrils lateral, near tip of snout. Diameter of eye six-sevenths that of snout, equal to distance between anterior angles of eyes. Tympanum distinct, its diameter one-half that of eye; tympanic region reentering, which makes the head circular. Mouth with curved lateral profile; its anteroposterior diameter one-half that of its transverse diameter. Vomerine teeth projecting in two contiguous groups between the choanae, scarcely extending behind them. Tongue large, heart shaped. Fore limb scarcely reaching to the coccyx; fingers half-webbed, in the following order of increase: 2, 1, 4, and 3; subarticular tubercles projecting; inner carpal tubercle greatly elongated, the external one absent. When hind leg is brought forward, heel reaches eye. Toes webbed, in the following order: 1, 2, 3, 5, and 4; web of second toe passes the excessively vestigial first and reaches the inner side of tarsus. Subarticular tubercles present, the inner metatarsal tubercle distinct, although small and oblong, the outer one vestigial. Skin of head free; all the upper parts smooth, with some scarcely apparent ridges in the periostial region of the marsupium; throat finely rugose; abdomen and lower surface of femur granular. Color that of coffee (faded in alcohol to Isabella color) ornamented with a black ellipse, with the center spotted, above the eyelids and another above each shoulder, a double median black stripe in the sacral region, and an elliptical pattern of small black spots extending from the shoulder to the mouth of the marsupium, where there is a black X, its two upper (anterior) arms external and its lower (posterior) arms internal to the mouth of the marsupium. Above the coccyx another interrupted ocellus, following a large transverse spot. A narrow rostropleural line coming from tip of snout through nostrils and margin of eyelids, bordering the tympani, and curving backward to the sides of the abdomen; in this oculo-abdominal distance the ornament enlarges into a regular fringe with very beautiful effect; another black line margins the lower side of the maxilla. Fore limb fringed externally with a black fretwork up to the outer finger; hind limb banded on upper part of femur and leg and up to web with another fretwork analogous to that of arm, up to the two outer toes. Body 75, leg 105 mm. One female coming from Macahé, State of Rio, by Sr. Ernesto Garbe. It has a pouch filled with about 24 eggs 8 mm. in greatest diameter.

Specimens examined

BRAZIL:

Rio de Janeiro: Serra de Macaé, ZSBS 66/37 (1), Schneider, 1936.

Gastrotheca microdisca (Andersson)

Plate 5, Figures c, d

1910. *Nototrema microdiscus* Andersson, *in* Lönnberg and Andersson, p. 9, fig. 6 (type locality, forest at Desiro Rivas, Paraná).—Baumann, 1912, p. 164.—Nieden, 1923, p. 325.

1911. *Nototrema fulvorufa* Andersson, p. 3, pl. 2 (type locality, near Santos, São Paulo).—Nieden, 1923, p. 322.

1926. *Opisthodelphis microdiscus* Miranda-Ribeiro, p. 112.

1926. *Gastrotheca fulvorufa* Miranda-Ribeiro, p. 110.—L. Müller, 1927, p. 267.

1930. *Hyla parkeri* (not of Gaige) deWitte, 1930a, p. 226, pl. 8, figs. 1, 2 (type locality, Alto da Serra, São Paulo).

1930. *Hyla parkeriana* deWitte, 1930b, p. 102 (new name for *Hyla parkeri* deWitte).

Description.—Adult female, MRHN IG 9404 Reg. 77, (type of *Hyla parkeriana*), Alto da Serra, São Paulo. Vomerine teeth in two very heavy but short and widely separated transverse series at the posterior level of the moderately large choanae; tongue a little more than one-half the width of mouth-opening, rounded, with a very deep notch on its free posterior border; snout moderate in length, rounded when viewed from above, truncate in profile, the upper jaw scarcely projecting beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about one-third that from eye, separated from each other by an interval almost as great as their distance from eye. Canthus rostralis well developed, gradually rising away from middle area of head which appears concave; loreal region slightly concave, the area below it almost vertical to edge of lip. Eye large, prominent, its diameter equal to its distance from nostrils; a low bony supraorbital ridge continuing backward from the canthal ridge and curving inwards to the center of the occiput; a heavy bony area from there to upper tympanic region, where a small knob of bone occurs; skin fairly loose and not closely involved with the bone of the head. Tympanum distinct, fairly small, its greatest (vertical) diameter equal to one-half that of eye, separated from eye by an interval equal to its own diameter; this area distinctly bony in texture and with the skin involved and immovable. Fingers webbed at the base, fourth very long, much longer than second, reaching to center of disk of third, which more than covers the tympanic area; a pronounced semicircular excrescence on base of first finger; a faint glandular ridge set with tubercles along outside of forearm, becoming more distinct on hand and fourth finger; toes a little more than half webbed, fourth extremely long, its disk amply covering the tympanic area, fifth slightly longer than third; a small inner and apparently no outer metatarsal tubercle; a distinct glandular ridge along inside of tarsus and a very weak one along outside of tarsus; a slight glandular ridge marked by tubercles across heel but no true dermal heel appendage. Body not elongate, moderate in build, in postaxillary region much narrower than greatest width of head; when hind leg is adpressed, heel reaches beyond tip of snout; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to the body, heels considerably overlap. Skin of upper parts very finely shagreened with a few small tubercles in the center of the back, in the preanal region, and on tibia; a heavy glandular fold beginning behind the eye, continuing above the tympanum, encountering the bony knob, and continuing straight back above the shoulder for a short distance, fading out as a loose fold of skin; a slight glandular line above anus; skin of throat and chest very faintly tubercular, that of belly, postanal region, and lower femur coarsely granular, with a pair of more or less regular lines of postanal enlarged glands ending in a large wartlike gland at the ventral surface; a few enlarged granules on back of lower femur; a heavy skinfold across the chest. (Vocal pouches probably lateral and external in the male.)

Dimensions.—Head and body 70 mm.; head length 23 mm., width 26 mm.; femur 36 mm.; tibia 39 mm.; hind limb 120 mm.; fore limb 44 mm.

Color in alcohol.—Dorsal ground color russet to walnut brown, with a few indistinct dark dots near the base of the tubercles and between the eyes; a narrow black line along canthus rostralis, below this a sepia area cut in two by an irregular wide white stripe; dark dots on upper lip below eye and on side of head; lateral ground color pearl gray, with small scattered dots and numerous, irregular, more or less quadrangular black spots, their upper borders fading out into the ground color of the back, their centers lighter or with small pale dots; a similar dark marking on the front of each shoulder; a slate-gray postanal patch bordered above by a narrow black line and a wider light area; upper surfaces of limbs with wide, chocolate, dark-edged crossbars, some having a border of small dark dots instead of a line; heel ridge bordered with slate color, the tubercles light buff; throat and chest drab, suffused with indistinct seal brown reticulations and dots; belly and lower limbs drab gray, indistinctly mottled with darker drab.

Remarks.—This species superficially resembles *Hyla venulosa* because of the diagonal dark and light blotches on the sides, the heavy crossbars on the legs, and the light patch under the eye. The feet are different, however, as the fourth toe is relatively longer and the web shorter in *G. microdisca.*

***Gastrotheca viridis* Lutz and Lutz**

1939. *Gastrotheca viridis* Lutz and Lutz, 1939a, pp. 81–83, 89, pl. 2, figs. 4, 4b, (type locality, Bonito, Serra da Bocaina, Rio de Janeiro).

Description.—Since no example of this species has been examined by me, the original description is reproduced as follows:

> *Gastrotheca viridis* is characterized by the partly pitted, but loose, skin over the head, light colour (apple-green) allied to striking markings, very short leg, smooth skin, subcircular, hardly emarginate tongue, and oblique groups of well-separated vomerine teeth, a combination of characters not found in any of the species described.
>
> *Holotype* (♀) and only specimen, from Bonito, Serra da Bocaina, at the limits of

the States of S. Paulo and Rio de Janeiro, collected January 1925 by B. Lutz and J. Venancio; in the Adolpho Lutz collection, at the Instituto Oswaldo Cruz, Rio de Janeiro.

Description: Skin over fronto-parietals, upper maxillaries and nasals partly pitted, not adherent to them.

Vomerine teeth in two short, well-separated, somewhat oblique groups between and slightly behind, the choanae. Tongue sub-circular, almost imperceptibly emarginate, posterior border slightly free. . . . Jaw thick, sloping out below. Snout rounded, about 1⅓ times as long as the eye. Canthus rostralis distinct, curved; loreal region very concave, sloping; nostril lateral, much nearer the tip of the snout than the eye. Tympanum distinct, its diameter half that of the eye. Interorbital space considerably wider than the upper eyelid.

Lateral fingers webbed at the base, 2d much shorter than the 4th; sub-articular and palmar tubercules well developed. Toes ½ webbed; 3d slightly shorter than 5th; a projecting inner metatarsal tubercle. Disks unequal, strikingly smaller on 1st finger and toe. . . .

Tibio-tarsal articulation barely reaching to the back of the eye.

Skin smooth above; granular beneath and on sides, in post-axillary region, gula and chest feebly so; a supra-tympanic ridge, a barely perceptible fold outlining the undeveloped dorsal pouch. Lower and posterior surface of thigh granular.

Colour: Green (apple-green) above, deeper on head and hind surface of thighs, greenish-white beneath. A very striking brown pattern edged in black, composed of a canthal stripe continued dorso-laterally over the eye, deflected downwards and ending in post-axillary region, an arcuate frieze on the tarsus from the heel to the tip of the 4th and 5th toes, with several arches, turned inwards; similar but more isolated arches on elbow, fore-arm and base of 4th finger; spots on the eyelids, two small ocelli behind the tympanum, near the mid-dorsal line, a few others, very small and scattered, in front of and to the sides of the dorsal pouch, a short black bar and small ocellus above the anus. Three small irregular spots on the legs, one of them on the knee, visible from beneath. All the spots and markings brown, edged in black. Alternate oblique, light-brown and white bars on the sides of body, from the end of the deflected dorso-lateral line to the groin, visible from above and below.

Thighs immaculate green above, with tiny white dots on hind surface, their lower surface citrine. Disks blue-green (nile) above. Hands and feet cream beneath. Outline of the mouth alternately black and white, central part white.

In spirits light grey, the black borders persistent.

Dimensions:

Snout to vent: 63 mm.
Fore limb: 43 mm.
Hind limb: 97 mm.
Head length: 21 mm.
" width: 23 mm.
Between the nostrils: 5 mm.
Interorbital space: 8 mm.

Diameter of upper eyelid: 5 mm.
Diameter of eye: 6 mm.
Diameter of tympanum (vert.): 3 mm.
Eye to tympanum: 4 mm.
" " nostril: 6 mm.
" " tip of the snout: 8, below 9 mm.

Sex: Female, with very loose skin, especially on the sides, except over the barely indicated dorsal pouch; small ovarian eggs.

Habitat: In epiphytic bromeliad, near a mountain-brook in rain-forest, at about 3,300 feet.

Remarks: Quite a number of Neotropical Hylids with dorsal pouches have been described, most of them, like ours, from only one or two specimens. Comparison with those known to us does not show our specimen as identical to any of them, including those occurring in more or less the same region of Brasil. From *N.*

microdiscus Anders. it differs by the loose skin of the cranium, colour and size. From *G. fulvo-rufa* Anders. by the colour, short leg, and smooth skin, from *Gastrotheca ernestoi* Mir. Rib., which is nearest to it, by the shape of the tongue and vomerine teeth and the still shorter leg colour and the simpler markings. Miranda Ribeiro makes no mention of unequal disks.

Affinities: In spirits, the colour of some species of Gastrothecas is dark. This does not generally occur in light frogs like ours, which do not turn darker but fade. Black borders and striking designs are seen in many species of Gastrotheca, but differ in detail.

Genus *Hyla* Laurenti

1768. *Hyla* LAURENTI, p. 32. (Genotype *Hyla viridis* Laurenti.)

Generic diagnosis.—Teeth present in upper jaw, or in both upper and lower jaws; shoulder-girdle arciferous; lateral sacral processes dilated; bone of last toe joint claw-shaped. Pupil horizontal. Tongue entire or slightly nicked, adherent or more or less free behind. Fingers free or webbed; toes webbed, the tips dilated into larger or smaller disks. Outer metatarsals united or slightly separated. Omosternum cartilaginous; sternum a cartilaginous plate. Diapophyses of sacral vertebra more or less dilated.

Remarks.—A careful study of several thousand specimens of Brazilian hylas has demonstrated the impracticability of attempting a dichotomous key to all the species, since the known individual variation in many of the characters normally used in making a key is so great that a category broad enough to include all the variants of a single species might include some parts of several closely allied species as well.

The most that can be attempted now, therefore, is the assembling of species together into several natural groups, based on a real affinity in structural characters, often with color similarities, and a statistical comparison of the critical measurements when sufficient material is available for this treatment. Subgeneric names have been proposed for most of these groups, but the consistent application of such group names must await the combined study of internal and external characters of the hylas of all the Americas, a truly Herculean task. In consequence of this, the keys for these groups must be used with some caution.

Some groups are relatively easy to discern after the first survey of species has been made. The largest frogs are contained mostly in Groups 1 (with heavily glandular skin) and 2 (with nearly smooth or slightly tubercular skin) while Group 4 is composed entirely of the smallest species with an immaculate red or yellow femur, and usually with a characteristic pattern elsewhere. Group 3 is composed mainly of species medium to fairly large in size, most of which have fairly well developed dorsolateral folds, relatively long snouts, relatively streamlined bodies, and other characters in common with the species chosen as typical of the group, *H. albopunctata.* Group 5 is the *H. rubra* group, nearly all of whose members may be told by the very wide tibia, and most of which have a characteristic marbled dark-and-light pattern on groin and femur. The predominantly green frogs may be placed in Group 6, although other green forms, such as those of the *aurantiaca* group, are not closely related to these. Group 7 contains the few species having short, blunt heads, an axilar winglike membrane, a femur with a large chocolate or reddish brown area posteriorly, and a rather characteristic dark dorsal pattern set off by tubercles; this group is exemplified by *H. marmorata senicula.* The excessively slender frogs are contained in Group 8 and the hatchet-faced *aurantiaca* allies in Group 9. Group 10, containing only *anceps,* and Group 11, containing only *goeldii,* do not link up closely with any other Brazilian forms represented in the material at hand from the limited territory under consideration.

1. *venulosa*—group

Three species of *Hyla, venulosa, mesophaea* and *imitatrix,* appear to form a closely related group characterized by several distinctive features: The wide head and rounded snout; the very similar proportions of limb and body; the large size of the adult; and, perhaps the most distinctive feature of all, the peculiar, overdeveloped vocal pouches of the male lying underneath the loose skin along the side of the neck below the tympanum. Of these, *venulosa* has by far the greatest range, being known from Central America southwards through most of the South American Continent to the Argentine; *mesophaea* ranges in Brazil from Espírito Santo and Bahia in the north to Rio Grande do Sul in the south; *imitatrix,* the most recently described of the three, is at present only known from Teresópolis, in the State of Rio de Janeiro.

William E. Duellman, now engaged in a comprehensive study of the *venulosa* group, writes in a letter of Oct. 29, 1953: "I am now considering *venulosa* to be a nomen dubium, the original description of which was based upon a ranidlike frog in Seba, and later misapplied by Daudin to the hylid that has been masquerading under that name for 150 years." Duellman considers the name *hebes* Cope applicable to those frogs occurring from the São Francisco drainage in Minas Gerais southward and westward through Paraguay into northern Argentina. Until the appearance of his paper, I think it best to retain the old name *venulosa* for the group as well as for the frogs from Minas Gerais, São Paulo, and Paraguay discussed in the following pages.

In five *venulosa* from Venezuela the head length averages 28.7 percent of the total length, in five *mesophaea* from Santa Catarina the head length averages 30.5 percent, while in three *imitatrix* at hand the average is 29.4 percent. With such a slight difference in averages, it is not possible to separate *venulosa* from the other two species on the length of its head. The head width is a little greater than head length in both *venulosa* and *mesophaea*, but nearly equal in *imitatrix;* hence, this seems to be a valid character for the separation of *imitatrix.*

Both of Boulenger's characters for separating *venulosa* and *mesophaea*—heel not reaching beyond eye and tarsal fold being absent in *venulosa*, the reverse in *mesophaea*—disappear in a comparison of even a rather small series of the two. The heel may reach to the posterior border of the eye or to the tip of the snout or to any point between in *venulosa;* in a series of five *mesophaea* it reaches from the center of the eye to the tip of the snout. The supposed distinction between them as to the development of a tarsal fold also breaks down entirely upon the examination of a few well-preserved examples of either species. In both forms, the tarsal fold may be absent, weak, moderate, or prominent.

Mirando-Ribeiro (1926, p. 68) states in his key that the toes of *mesophaea* are webbed up to the disks, while in the other two species the webs extend only to the penultimate phalanx. The toes of all the examples of *mesophaea*, *venulosa* and *imitatrix* at hand are about three-quarters webbed, with the usual slight variation in both directions; hence, this character also is not to be relied on. Even the texture of the skin is not infallible, as it may be either smooth or granular in *imitatrix* and *venulosa* but usually thick in either case. The five *mesophaea* at hand have a uniformly smooth and relatively thin skin, which does not seem to possess the heavy glandules found in most specimens of *venulosa*.

Besides the texture of the skin, the color pattern seems to differentiate *mesophaea* and *venulosa*. In *mesophaea*, the outer corners of the light triangle on the snout continue as definite straight, dark-edged, light dorsolateral stripes, with a fairly uniform dark rectangular area covering the whole of the back, while the arms and legs do not have any distinct pattern of spots or blotches, but remain a uniform brown in alcohol. In *venulosa*, on the other hand, while the light triangular area on the snout is often quite definite, the dorsolateral light stripes when present are usually very irregular in outline, often running in diagonal branches onto the side, or ending at midbody, giving place to large irregular dark and light blotches which cover the posterior part of the body, and make heavy crossbands on the arms and legs.

These differences are summarized in the following key:

a^1. Head broader than long.
  b^1. Skin usually very thick, glandular; pattern of dorsolateral light stripes usually irregular; arms and legs heavily crossbarred **venulosa** (p. 63)
  b^2. Skin moderately thin, smooth; dorsolateral light stripes usually regular; arms and legs without definite bars . . . . **mesophaea** (p. 60)
a^2. Head as long as broad . . . . **imitatrix** (p. 57)

Hyla imitatrix Miranda-Ribeiro

Figure 6; Plate 5, Figures e, f

1926. *Hyla imitatrix* Miranda-Ribeiro, p.77 (type locality, Teresópolis, Organ Mountains, Rio de Janiero.

Description.—Adult male, USNM 101722, Teresópolis, Rio de Janiero. Vomerine teeth in two very heavy, transverse, narrowly separated series behind the choanae; tongue three-fifths as wide as mouth-opening, cordiform, slightly notched on its partially free posterior border; head as broad as long; snout moderate in length, rounded when viewed from above, rather truncate in profile; nostrils more lateral than superior, very slightly projecting, their distance from end of snout about two-fifths that from eye, separated from each other by an interval almost as great as their distance from eye. Canthus rostralis prominent, loreal region concave, the upper labial region jutting out sharply below it. Eye moderately large, fairly prominent, its diameter equal to its distance from nostril; interorbital diameter slightly greater than that of upper eyelid, 1⅓ times the width

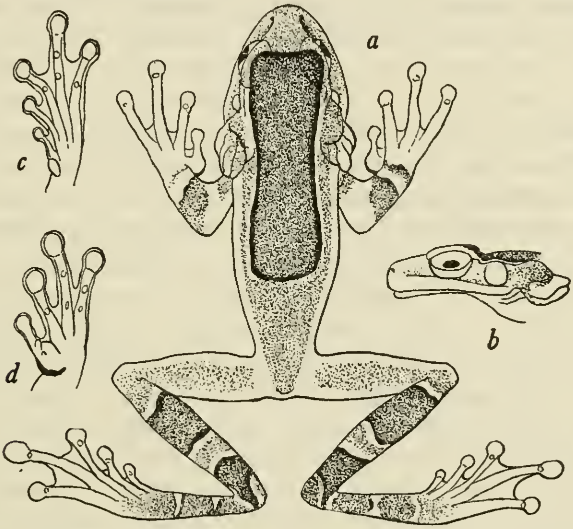


Figure 6.—*Hyla imitatrix*, USNM 101722: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × 1.

between nostrils. Tympanum very distinct, about four-fifths diameter of eye, separated from eye by an interval equal to one-half its own diameter. Fingers one-third webbed, fourth much longer than second, reaching to base of disk of third which covers the entire tympanic area; no pronounced pollex; toes three-fourths webbed, third and fifth subequal, disk of fourth covering about four-fifths of the tympanic area; an oval inner metatarsal tubercle and an extremely small, wart-like outer one; a narrow well-marked glandular line on inner side of tarsus; no outer tarsal ridge; no dermal appendage on heel; body rather elongate and only moderately heavy in build; in postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow slightly overlap; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts thick, beset with small spiny tubercles (in the male) which appear even on the upper lip and on the exposed limb surfaces; skin of throat slightly granular, that of chest smooth, that of belly and posterior lower femur coarsely granular. A slight skinfold across the chest. A pair of very prominent lateral external vocal sacs ending behind the tympanum; a heavy black corneous pad on base of first finger.

Dimensions.—Head and body 53 mm.; head length 16 mm., width 16 mm.; femur 24 mm.; tibia 26 mm.; foot 23 mm.; hand 17 mm.

Color in alcohol.—Ground color drab gray; a large drab parallelogram edged with slate color extending from the anterior corner of each eyelid back to the sacrum; below its straight lateral borders a pale drab-gray lateral stripe extending from the posterior corner of the eye; sides below this light stripe suffused with drab; femur drab above but without definite markings; tibia with wide drab sepia-edged crossbars separated by a pale drab narrow stripe; forearm with faint traces of similar markings; ventral surface olive-buff on throat and belly, buff on legs, immaculate. Anterior part of head in front of eyes pale immaculate drab gray, including upper lip.

Color in life.—In the original description Miranda-Ribeiro (1926, p. 77) gives the very adequate notes translated here: "The color imitates that of *H. quadrangulum*, having in life an olive green or sepia ground, more yellowish on the abdominal surface. A large quadrilateral goes from eye to sacrum; its corners are rounded and it is delineated by a black line, externally bordered by another white one; in the middle of the space thus limited, the color of which is sepia, larger black spots and other smaller white ones; a transverse sepia border on the forearm margined with black and white; others on the femur, neither always present, and one or two on the leg. This is the coloration of the male; the female has one or two ocelli after the quadrangle, and various spots and another obscure longitudinal line on the flanks; the transverse borders of the legs are more frequently two or three."

Variations.—Two adult specimens were received from Miranda-Ribeiro with the one which serves as the basis for the above redescription. Of these, the male, USNM 101724, has the skin highly spinose from the thickly scattered tubercles. Structurally it is not different from the described specimen, but its color is much darker, the whole dorsal surface having turned to seal brown or chocolate to such an extent that the dorsal quadrilateral is only faintly discernible. Femoral bands, however, are plainly distinguishable. A few small brown spots occur along the sides of the belly extending into the region of the axilla and groin. The other specimen, USNM 101723, a female, shows the brighter, more complicated pattern described by Miranda-Ribeiro. The legs in particular are brilliantly crossbanded, including even the feet. Its skin is thick above but quite smooth except for some granules behind the ear and along the side. A fourth specimen, FMNH 9006, also a topotype, taken by K. P. Schmidt, agrees in every essential with the specimens described above.

It will be interesting to learn the extent of stability in the sexually dimorphic color pattern on a large series of individuals of this species. Apparently males and females of the related species *H. venulosa* are patterned alike, while the skin texture of the male does not differ materially from that of the female in any of the specimens examined. In *H. mesophaea,* the patterns of both sexes are also alike, while only one out of the four males in the series has a roughened skin, MP 268, from Espírito Santo, although this is perhaps due to the season of capture, since skin rugosities may be present only during the breeding period.

Remarks.—Barbour and Dunn (1921) described from the main stream of the Amazon between Manáos and Teffé a frog which they named *Paludicola imitator.* Parker (1927b) pointed out that this species is a *Hyla.* Therefore in Brazil we have *Hyla imitator* (Barbour and Dunn) from the Amazon region, and *Hyla imitatrix* Miranda-Ribeiro from Rio de Janiero.

The recommendations under Article 36 of the International Rules of Zoological Nomenclature caution against introducing similar specific names ending in *-tor* and *-trix* into a single genus. But the recommendation states that "once introduced, such names are not to be rejected on that account."

Specimens examined

BRAZIL:

Rio de Janeiro: Teresópolis, USNM 101722–4, Miranda-Ribeiro; FMNH 9006, K. P. Schmidt, July 2, 1926; MHNP 31/45–46, Miranda-Ribeiro.

Hyla mesophaea Hensel

Figure 7

1856. *Hyla leucophyllata* (not of Beireis) Burmeister, p. 104, pl. 31, fig. 4.
1867. *Hyla mesophaea* Hensel, p. 154 (no type locality given).—Peters, 1872b, p. 772.—Boulenger, 1882a, p. 366; 1886b, p. 444.—Werner, 1894a, p. 413.—Baumann, 1912, p. 163.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 291.—Miranda-Ribeiro, 1926, p. 75, pl. 10, figs. 1, 1a.—B. Lutz, 1947, p. 243.—Mertens, 1950, p. 175.

Description.—Adult male, USNM 70518, Angra dos Reis, Rio de Janeiro. Vomerine teeth in two very heavy, transverse, narrowly separated series behind the choanae; tongue two-thirds as wide as mouth-opening, cordiform, deeply notched on its partially free posterior border; head broader than long; snout moderately short and rounded when viewed from above, rounded in profile; nostrils superolateral, slightly projecting, their distance from end of snout about half that from eye, separated from each other by an interval very slightly less than their distance from eye. Canthus rostralis prominent, loreal region very concave, the upper labial region jutting out sharply below it. Eye moderately large, rather prominent, its diameter slightly greater than its distance from nostril; interorbital diameter slightly greater than width of upper eyelid, 1½ times the width between nostrils. Tympanum very distinct, about two-thirds the diameter of eye, separated from eye by an interval equal to about half its own diameter. Fingers one-third webbed, fourth much longer than

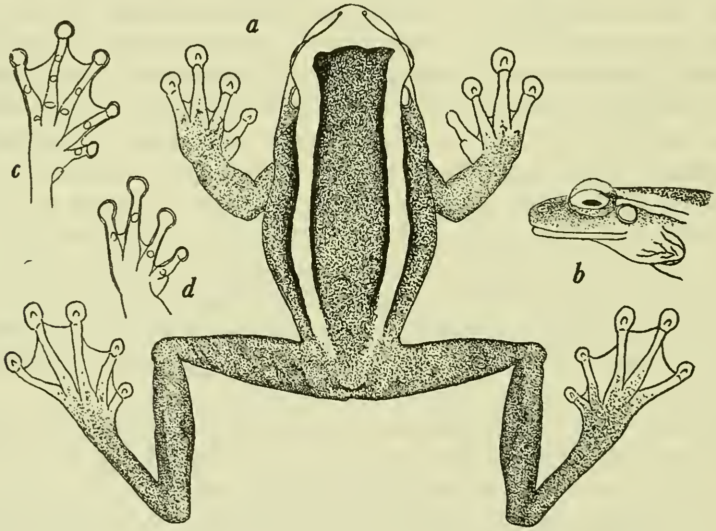


Figure 7.—*Hyla mesophaea*, USNM 70518: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × ¾.

second and reaching to base of disk of third, which slightly exceeds the tympanic area; no pronounced rudiment of a pollex; toes three-fourths webbed, third and fifth subequal, disk of fourth covering about three-fourths of the tympanic area; a distinct, large inner and a very minute outer metatarsal tubercle; a faint inner glandular tarsal ridge; no dermal appendage on heel; body rather elongate but heavy in build, in postaxillary region slightly wider than greatest width of head; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow fail to meet by a considerable interval; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts thick and coarsely glandular; a narrow glandular supratympanic ridge; skin of throat sparsely granular, that of chest nearly smooth, that of belly and posterior lower thigh very heavily granular. A skinfold across the chest. A pair of very prominent lateral external vocal sacs in the male, appearing as heavy folds of skin in front of the shoulders; a distinct, swollen, roughened, dark nuptial pad on the base of first finger.

Dimensions.—Head and body 67 mm.; head length 20 mm., width 21 mm.; femur 29 mm.; tibia 32 mm.; foot 32 mm.; hand 20 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	5	5	5	5	5	5
Mean	30. 5	31. 7	44. 8	51. 3	49. 7	31. 1
Standard deviation	1. 6	. 92	1. 5	2. 7	2. 9	1. 6
Variation	5. 2	2. 9	3. 3	5. 3	5. 8	5. 1
Standard error	. 72	. 41	. 67	1. 20	1. 30	. 72
Range	27. 9–30. 5	30. 8–33. 3	42. 7–46. 5	48. 5–54. 5	45. 5–53. 4	29. 4–33. 3

Color in alcohol.—Dorsum pale seal brown; a pale olive-gray area, triangular in shape, on top of head in front of eyes and extending backward above the tympanum on each side of the body to the groin as a wide dorsolateral band, the edges of which are emphasized by an abrupt, darker line of seal brown; a few scattered olive-gray spots along the middle of the back; sides of head olive-gray, upper surface of arms and legs vinaceous buff. Ventral surfaces immaculate pale buff.

Color in life.—From painting without data, presumably by Sandig. Dorsal surface olive, darkening to clove brown on top of head, becoming slightly paler on top of snout; a very light olive-gray dorsolateral band beginning on sides of snout and continuing from behind the eyes almost to groin; limbs light olive-green. Iris maize yellow at the center, tinged with orange at the periphery, crossed by a few zigzag black lines. Pupil a transverse black slit, its upper and lower margins notched.

Variations.—Of the five examples of this species now in the National Museum, two males show the dark, roughened patch on the inner part of the first finger. Three of the specimens have the inner metatarsal tubercle less distinct than in the one chosen for description. The general proportions, amount of webbing, position of vomerine teeth and other structural features appear extremely uniform in the few specimens at hand. The light dorsolateral stripe is very narrow in the additional examples and two of them are darkened by preservative so that the pale area in front of the eyes is scarcely visible; nevertheless the pattern is there in its essentials. The Museu Paulista example appears everywhere covered with prominent glandular tubercles, but this corruscation is probably due at least in part to the method of preserving, as the whole specimen is hardened and stiff as if from a solution of strong formalin. It agrees entirely with the other specimens except in the matter of size and rugosity of skin.

Remarks.—Adults are found in trees, in bromeliads, and in lagôas (i. e., shallow pools). The voice is said to be *krack, krack, krack*, somewhat like that of a hen cackling.

Specimens examined

BRAZIL: ZMB 30444; ZMB 33-3133, Sello; KZAEM 98, Holstein; BM 64.1.19.-34, Wucherer; BM 98.11.30.62, von Ihering.

BAHIA: ZMB 33-7496 (2), Michaelis.

ESPÍRITO SANTO: MP 268.

RIO DE JANEIRO: Angra dos Reis, USNM 70518, Metcalf, Oct. 14, 1925; ZSBS 60/1947, A. Lutz, 1932.

RIO GRANDE DO SUL: Pôrto Alegre, ZMB 33-6256, Michaelis, ZMB 33-6810, Hensel.

SANTA CATARINA: Hansa, USNM 81129, Erhardt; USNM 98775–6, Globig; BM 1928.11.5.89–106, Erhardt, Humboldt, BM 1910.7.26.3–6, Erhardt; ZSBS 351/1920 (5), Erhardt, 1920. Rio Itapocú, ZSBS 247/23 (3), 338/1920, Erhardt, 1920. Rio Humboldt, USNM 65570, Fritsche, 1918; BM 1923.-6.1.84–91, Fritsche. Teresópolis, ZMB 26322, Michaelis.

***Hyla venulosa* (Laurenti)**

FIGURE 8

1768. *Rana venulosa* LAURENTI, p. 31 (type locality, "habitat in Indiis").

To the synonymy given by Nieden (1923, p. 244) add the following:

1892. *Hyla venulosa* BOETTGER, p. 40; 1893, p. 40.—BOULENGER, 1894, p. 348; 1898a, p. 133; 1903a, p. 69.—PERACCA, 1895, p. 29; 1897, p. 18; 1904a, p. 13; 1904b, p. 37.—BUDGETT, 1899, pp. 305, 327.—GÜNTHER, 1901, p. 272.—STEJNEGER, 1901, p. 180.—MÉHELY, 1904, p. 226.—E. G. BOULENGER, 1911, p. 1082.—BEEBE, 1919, p. 208.—PROCTER, 1921, p. 192.—RUTHVEN, 1922, p. 55.—NIEDEN, 1923, p. 244.—COTT, 1926, p. 1160.—MIRANDA-RIBEIRO, 1926, p. 76, fig. 43; 1937a, p. 55.—A. LUTZ, 1927, pp. 39, 44, pl. 14, figs. 33, 34.—Nicéforo-Maria, 1930, p. 104.—Crawford, 1931, p. 35.—Noble, 1931, p. 426.—Kellogg, 1932, pp. 155, 176.—Müller and Hellmich, 1936, p. 80, fig. 28.—Carvalho, 1939a, p. 280.—Schubart, 1939, p. 52.

1874. *Scytopis venulosus* Cope, p. 124.

Description.—Adult female, USNM 98537, Piraporinha, Minas Gerais. Vomerine teeth in two very heavy, short, straight patches, narrowly separated on the midline, lying between the choanae; tongue half as wide as mouth-opening, rounded, with a very slight indentation in its posterior border, which is scarcely free; head broader than long; snout very short, bluntly rounded when viewed from above, slightly truncate in profile, the upper jaw scarcely extending beyond the lower; nostrils superolateral, prominently projecting, their distance from end of snout about one-third that from eye, separated from each other by an interval equal to slightly less than their distance from eye. Canthus rostralis blunt but well defined, loreal region concave, sloping. Eye large, prominent, its diameter two-thirds its distance from end of snout; interorbital diameter equal to width of upper eyelid which is very broad, almost twice that of distance between nostrils. Tympanum very distinct, about two-thirds the diameter of the eye, separated from eye by an interval equal to nearly its own diameter. Fingers one-third webbed, fourth much longer than second, reaching to base of disk of third which covers about three-fourths of the tympanic area; no pronounced pollex; toes three-fourths webbed, third and fifth subequal, disk of fourth covering one-half the tympanic

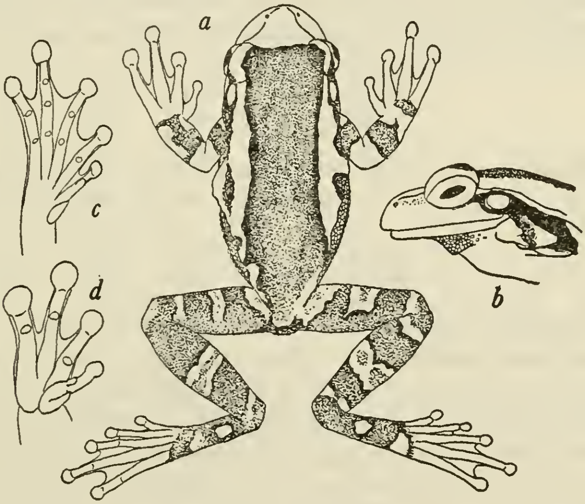


Figure 8.—*Hyla venulosa*, USNM 98537: *a*, Dorsum; × ½; *b*, profile × ½; *c*, foot, × ¾; *d*, hand × ¾.

area; an oval, inner metatarsal tubercle and an extremely small, wartlike outer one; a narrow but well-marked glandular line on inner side of tarsus; no dermal appendage on heel; body heavily built, in postaxillary region slightly less than greatest width of head; when hind leg is adpressed, heel reaches to anterior corner of eye; when limbs are laid along sides, knee and elbow just touch; when hind legs are bent at right angles to the body, heels slightly overlap. Skin of upper parts thick and finely shagreened, with small pustules on posterior part of back and larger ones on the dorsolateral region, where two or three heavy skinfolds occur; a wide, low glandular ridge encircling upper part of tympanum, with numerous heavy pustules around lower border of ear; skin of throat rather coarsely granular, that of chest less distinctly so, and that of abdomen and lower thighs heavily granular; a heavy skinfold across chest, and another on throat. (Two external lateral vocal sacs and a horny dark patch on the thumb in the male.)

Dimensions.—Head and body 87 mm.; head length 25 mm., width 29 mm.; femur 37.5 mm.; tibia 39 mm.; foot 34.5 mm.; hand 27.5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	44	44	30	42	30	30
Mean	29. 3	33. 0	44. 3	48. 5	39. 5	30. 6
Standard deviation	1. 87	2. 02	2. 12	2. 29	2. 09	1. 48
Variation	6. 4	6. 1	4. 8	4. 7	5. 3	4. 8
Standard error	. 28	. 30	. 39	. 35	. 38	. 27
Range	25. 2– 34. 8	28. 9– 37. 8	39. 4– 58. 4	43. 8– 53. 6	35. 4– 44. 5	27. 5– 34. 7

Color in alcohol.—Body color ecru-drab; an elongate, rectangular seal-brown dorsal marking extending anteriorly between the eyes and onto the eyelids, then backwards to the sacral region where its clove-brown borders fade out and become rather irregular; a wide, clove-brown lateral stripe beginning at the posterior corners of the eyes, widening behind the tympanum, and breaking up behind the axilla into a number of large spots; legs and arms with wide sepia crossbars edged with a darker brown and separated by narrow drab areas; a dark anal patch, light-bordered anteriorly; lower surfaces wood brown, paler on chest, with numerous fine drab reticulations on abdomen and throat; sides and end of snout slightly suffused with olive.

Variations.—Another individual, USNM 98536, from the same spot as the described specimen, apparently a female, is practically identical with it except in having a slightly smaller tympanum.

Two males, USNM 28926 and 28927 from Lower Amazonia, are much smaller than either of the two females from Piraporinha, as the largest male, with fully extended lateral vocal sacs and a brown horny growth on the inner base of the thumb, measures only 62 mm. in length. These two are a uniform, dark seal brown above, without any traces of the rectangular dorsal marking set off by a drab bordering area which characterizes both of the Minas Gerais specimens. The banding on the thighs of the males is reduced to a few reticulations, but the tibia in one of them shows some banding, although in this instance the dark bands are narrower than the intervening light areas.

Remarks.—The two cotypes of *Hyla zebra* Duméril and Bibron, MHNP 421, are soft and faded, but some vertical dark postfemoral bars are still discernible. The skin on the head and body of the larger specimen is tubercular; that of the smaller specimen is less so. Both have a wide head like that of *H. venulosa.* Three cotypes of *H. fusca* Daudin, MNHP 419–20, are likewise flabby and faded, but the round snout like that of *venulosa* is still apparent. The toes are two-thirds webbed, the fingers webbed only at the base. It seems possible that the chestnut-colored type described by Daudin was a *venulosa* with a uniform dorsal coloration, like that already mentioned in regard to two specimens from Lower Amazonia. It seems probable, therefore, that *zebra* and *fusca* should be made synonyms of *venulosa.*

Specimens examined

BRAZIL:
  Amazonas: BM RR 1936.12.3.119. Santarém, BM 56.3.25.14, Bates.
  Bahia: ZMB 31/7468, Wucherer.
  Minas Gerais: Piraporinha, USNM 98536–7, Cochran and Venancio, Mar. 23, 1935.
  Pará: BM 97.1.7.2, Goeldi; BM 45.8.25,143, Graham. Bosque, BM 1926.-5.26.4, Cott. Caldeiro, Ilha Marajó, ZMB 29999, Flemming. Ilha Marajó, BM 1923.11.9.25–26, Erhardt. "Lower Amazonia," USNM 28926–7, Steere, 1900.
  Pernambuco: ZMB 25966, 26076, Heller.
  São Paulo: Xiririca above Iguapé, CM 2657, Haseman, Dec. 9, 1908.
ARGENTINA: USNM 73532, Breyer brothers.
BOLIVIA: Ixiamas, MZUM 57529 (2), Pearson, December 1921.
BRITISH GUIANA: Kartabo, NYZS N (1), Beebe.
ECUADOR: USNM 14054, Jones, Dec. 18, 1884.
FRENCH GUIANA: Cayenne, MHNP 1793, Poiteau.
PARAGUAY: USNM 5837 (type of *Scytopis hebes* Cope), Page. San Bernardino, ZMB 26054, 26115, Fiebig.
SURINAM: MRHN 4544 Reg. 333g, MRHN IG 455 Reg. 333b (2); USNM 14618, Hering, Sept. 4, 1885. Berg en Dal, ZMB 31-7276, Muhler. Paramaribo, USNM 13820–1, Hering, Mar. 18, 1885.
VENEZUELA: Caicara, USNM 36377, Cherrie, May 5, 1905. Carapa, USNM 80612, Holt, Nov. 20, 1929. Caripito, NYZS 30013–4, 30106, 30140, 30167, 30180, Beebe, 1942. La Guayra, USNM 22545, Robinson, June 22, 1895, USNM 27797, Lyon and Robinson, July 3, 1900. Maracay, USNM 128792, Mondolfi and Vivas-Berthier, May 28, 1939.

2. *faber*—group

The species of this group of hylids—*crepitans, faber, langsdorffii,* and *pardalis*—are all rather large in size, and have a flattened or concave head, a prominent pollex rudiment equipped with a spur in the males, and usually a smooth, thin skin which may have some minute glandular ridges, but which is not similar to the heavy, thick integument found in species of Group 1. One of the species, *pardalis,* has skin of a rougher texture than others of the group, owing to the scattered tubercles that appear in some individuals.

These frogs range rather widely; *crepitans* occurs from Trinidad, the Guianas, and Venezuela south to Santa Catarina, Brazil; the smith frog, *faber,* whose voice sounds like the clangor of a blacksmith's shop, is known from Minas Gerais to Rio Grande do Sul; *langsdorffii* is less common than the two preceding, but is known from Bahia to Santa Catarina; *pardalis* is found from Venezuela and Surinam south to São Paulo.

For a statistical analysis of measurements of members of the *faber* group here discussed, see pages 373 and 375.

Key to frogs of Group 2 from southeastern Brazil

- *a*¹. A distinct dermal appendage or tubercle on heel; skin fairly rough, with scattered tubercles; a serrate skinfold along outer surface of arm and leg; toes three-fourths or more webbed; fingers entirely webbed. **pardalis** (p. 76)
- *a*². No true appendage or tubercle on heel, but sometimes a dermal ridge; skin relatively smooth; no dermal fold along arm or leg.
  - *b*¹. A prominent dark middorsal line usually present, at least anteriorly; toes one-half or more webbed; fingers one-third webbed . . . . . **faber** (p. 70)
  - *b*². No dark middorsal line; toes three-fourths webbed.
    - *c*¹. Fingers webbed only at base; top of femur with several dark bands continuing as narrow lines on posterior femur, sometimes encircling it . . . . **crepitans** (p. 66)
    - *c*². Fingers one-half webbed; top of femur with 2 or 3 transverse blotches, posterior femur immaculate . . . . **langsdorffii** (p. 73)

***Hyla crepitans* Wied**

PLATE 6, FIGURES A–D

1824. *Hyla crepitans* WIED, 1824a, pl. 47, fig. 1 (type locality, Tamboril, Jiboya, and Areal da Conquista, Bahia); 1824b, p. 671; 1825, p. 525.—BURMEISTER, 1856, p. 103.—PETERS, 1872b, p. 771; 1877, p. 460.—BOULENGER, 1882a, p. 352; 1903b, p. 481.—BOETTGER, 1885, p. 247; 1892, p. 40; 1893, p. 40.—WERNER, 1899b, p. 482.—GÜNTHER, 1901, p. 283.—STEJNEGER, 1901, p. 181.—BAUMANN, 1912, p. 163.—PERACCA, 1914, p. 108.—BEEBE, 1919, p. 207.—RUTHVEN, 1922, p. 55.—NIEDEN, 1923, p. 304.—A. LUTZ, 1927, pp. 38, 43, pl. 15, figs. 35, 36.—NICÉFORO-MARIA, 1930, p. 104.—CRAWFORD, 1931, p. 34.—SCHMIDT, 1932, p. 160.—PARKER, 1935, p. 511; 1939, p. 87.—MIRANDA-RIBEIRO, 1937a, p. 55.—HELLMICH, 1939, p. 391.—SCHUBART, 1939, p. 52.—SHREVE, 1947, p. 536.

1830. *Hypsiboas crepitans* Wagler, p. 200.—Cope, 1867, p. 200; 1874, p. 121.
1841. *Hyla levaillantii* Duméril and Bibron, p. 550 (type locality, Surinam).
1841. *Hyla leprieurii* Duméril and Bibron, p. 553 (type locality, Cayenne).—Boulenger, 1882a, p. 361.—Baumann, 1912, p. 163.—Beebe, 1919, p. 208.—Nieden, 1923, p. 305.—Miranda-Ribeiro, 1926, p. 81.
1904. *Hyla leprieuri* Lidth de Jeude, p. 94.—Crawford, 1931, p. 34.
1867. *Hypsiboas circumdatus* Cope, p. 200 (no description; type locality, Brazil); 1870, p. 555.
1882. *Hyla circumdata* Boulenger, 1882a, p. 353.—Baumann, 1912, p. 163.—Nieden, 1923, p. 305.—Miranda-Ribeiro, 1926, p. 92, fig. 53.—Barbour and Loveridge, 1929, p. 278.

Description.—Adult female, USNM 52610, Toca da Onça, Bahia. Vomerine teeth in two very heavy /‾‾\-shaped patches nearly continuous medially between and behind the large choanae; tongue more than two-thirds the width of mouth-opening, broadly cordiform, very deeply notched on its free posterior border; snout short, rounded when viewed from above and in profile, the upper jaw slightly extending beyond the lower; nostrils more lateral than superior, slightly projecting, their distance from end of snout about three-fifths that to eye, separated from each other by an interval almost as great as their distance from eye. Canthus rostralis fairly prominent; loreal region concave, slightly oblique, the area below it flaring moderately to the edge of the lip. Eye large, very prominent, its diameter almost as great as its distance from end of snout; interorbital diameter about equal to width of upper eyelid, slightly greater than distance between nostrils. Tympanum very distinct, moderate, about one-half the diameter of eye, separated from eye by an interval equal to about one-third its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching to base of disk of third which covers almost half the tympanic area; a pronounced tuberclelike pollex on inner part of first finger; a faint glandular ridge along outside of forearm; toes a little less than three-fourths webbed, third and fifth subequal, disk of fourth covering almost half the tympanic area; a large blunt inner and an almost imperceptible granulelike outer metatarsal tubercle; a distinct glandular ridge along inside and a very faint one along outside of tarsus; a glandular ridge across heel and a skinfold below heel, but no true dermal heel appendage. Body not elongate, fairly heavy in build, in postaxillary region a little narrower than greatest width of head; when hind leg is adpressed, heel reaches well beyond tip of snout; when limbs are laid along the sides, knee and elbow considerably overlap; when hind legs are bent at right angles to the body, heels overlap. Skin of upper parts smooth except for some very minute glandular striations on the back; a very heavy glandular fold overhanging upper border of ear and dropping down behind it to end above the shoulder; a weak glandular transverse line above the anus; skin of throat and chest finely granular, that of belly and lower part of femur heavily granular, with two lines of heavy round glandules below the anus and another line of coarse glandules along the back of the femur halfway to knee; a heavy skinfold across the chest. (A median vocal sac in the male.)

Dimensions.—Head and body 65 mm.; head length 21 mm., width 23 mm.; femur 34 mm.; tibia 36 mm.; foot 25 mm.; hand 19 mm.

Color in alcohol.—Dorsal ground color wood brown with an indistinct, darker Y-shaped drab marking on the back, the anterior prolongations going to the eyelids, the posterior part widening and gradually merging with the ground color on the sacrum; a few small sepia spots irregularly scattered on the back; upper part of femur with three or four indistinct wide drab bars which break up on the pale posterior surface of the femur into more than a dozen narrow wavy russet lines; anterior surface of femur without definite markings, slightly suffused with pale brown or drab; arm, tibia, and foot with wide, indistinct, drab-to-sepia crossbars containing many fine sepia spots and some larger coarse ones; a sepia patch on each heel below the pale glandular ridge, and a similar one on the anal region; upper and lower lip wood brown with irregular drab spots; chin suffused with drab; chest, belly and lower part of limbs immaculate cream color; sides with a few wavy sepia lines like those behind the femur, appearing to terminate the drab dorsal markings.

Variations.—In a fine series of eight adults, USNM 80676–83, from Puerto Ayacucho, Amazonas, Venezuela, the vomerine teeth are usually rather short, heavy, more or less slanting patches extending from the middle of the choanae past their posterior level, but one individual, 80677, has them in narrow, elongate /‾ ‾\-shaped patches which begin between the anterior level of the choanae. The heel adpressed reaches to between the anterior corner of the eye and beyond the tip of the snout. The tympanum in this series varies from one-half to three-fourths the width of the eye. The dorsal Y-shaped mark is present in all these specimens, although greatly obscured in some by the dark dorsal coloration. On the lightest specimen the drab dorsal pattern becomes a coarse network on top of head and snout, as well as on sides of body. The narrow dark lateral lines, as well as the postfemoral lines, appear to be constantly present, although these latter may be many or few in number. Two of these eight frogs have a dark narrow median dorsal line from tip of snout to center of back.

An example measuring 43 mm. from the Serra de Macaé, USNM 102550, may be the young of this species, although its nose, seen in profile, slants forward instead of being bluntly truncate, as is true of a young Bahia specimen of 40 mm. (MP 469). The vomerine teeth in both these young frogs are less extended posterolaterally than in adults from Venezuela. The finger webs of the young frogs are also a little less developed; otherwise, the specimens agree very well. On the Bahia frog a vestige of color pattern still remains, and this is typical of that found in most adult *H. crepitans*.

Although *H. circumdata* has been considered distinct from *crepitans* ever since its description by Cope in 1867, a study of variation demonstrates the inclusion in *crepitans* of every character supposed to differentiate *circumdata*. The most obvious one, the appearance of narrow dark lines on the front as well as on the top and rear of the femur, supposed to be a characteristic of *circumdata* alone, is found to occur in all degrees of distinctness in a series of *crepitans*. The heel may be smooth, or may have a ridge or tubercle in a series containing plain and lined femora. The limb and head proportions, and the webbing of feet and hands, are likewise similar.

An adult *crepitans* with a median dark dorsal line, which occasionally appears in this species, is very suggestive of a half-grown *H. faber*. The head contour and body proportions may also be singularly alike, especially if one of the shorter-legged examples of *faber* be chosen for comparison.

The type of *Hyla leprieurii* Duméril and Bibron, MHNP 389, has the toes half webbed and the fingers webbed only at the base; there are no lateral skin serrations on the legs or arms, and the coloration consists of dark rectangular spots across the back, wide dark bars on the legs, and a dark canthal line and ear patch.

Remarks.—Although *H. crepitans* has an external head shape and internal tooth structure very different from *H. raniceps*, they may often be confused, on superficial examination of color pattern alone, because of the somewhat similar style of crossbanding on the hind legs.

Specimens examined

BRAZIL: MHNP 4624, Claussen.

Bahia: Bahia, USNM 75987, de Lacerda; MP 469; NHMW 1109, Wucherer. Toca da Onça, USNM 52610, Rose, June 27, 1915.

Districto Federal: Rio de Janeiro, MCZ 1508 (cotype of *Hyla circumdata*), Thayer Expedition, 1864–65. ZSBS, A. Lutz, 1932.

Minas Gerais: Agua Limpa, Ouro Prêto, USNM 98020, Cochran, Dias, and Venancio, Mar. 19, 1935. Areal do Callias, MCZ 1873. Riachão da Cruz, IB 304–8. Rio Arassuahy, MCZ 1874 (3).

Paraíba: Campina Grande, USNM 109164, von Ihering. Elembuzeiro, USNM 109165–6, von Ihering. Independencia, CAS 49685, Heath, July 2, 1911.

Pernambuco: Bonito, MCZ 2825 (3). Caruarú, USNM 97095, Pickel, January 1928; USNM 109163, von Ihering. Garanhuns, BM 81.7.4.4, Forbes. Tapera, USNM 97066, Pickel, July 13, 1932.

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96645–7, A. Lutz. Independencia, near Petrópolis, USNM 97644, A. Lutz, B. Lutz, and Cochran, May 5, 1935. Petrópolis, MCZ 2497. Serra de Macaé, USNM 102550.

Santa Catarina: Joinville, USNM 101453–4, 1930. Lages, BM 88.2.7.12, Michaelis.

São Paulo: Alto da Serra, MRHN IG 9404 Reg. 38g, Massart, Oct. 6, 1922; USNM 96783, A. Lutz, Jan. 25, 1924; USNM 97774, Cochran and Venancio, Apr. 25, 1935. Boracea, MHNP 50-250 (2) Bokermann, December 1948.

FRENCH GUIANA: Cayenne, MHNP 389 (type of *Hyla leprieurii*).

SURINAM: MHNP 764 (type of *H. levaillantii*), Levaillant.

TRINIDAD: USNM 17772–4. Wayman, 1891.

VENEZUELA: Caicara, USNM 36376, Cherrie, May 1905. Caracas, USNM 55329–30, Rose, October 1916. Caripito, NYZS 30096, 30109, 30205, Beebe, 1942. La Guayra, USNM, 22541–4, Robinson, June–July 1895; USNM 27791, 27794–5, Lyon and Robinson, July 2–10, 1895. Puerto Ayacucho, USNM 80676–83, Holt, Mar. 7, 1930. San Juan de la Morros, USNM 72756, Pittier.

***Hyla faber* Wied**

Plate 5, Figures g, h

1821. *Hyla faber* Wied, p. 519 (type locality, Fazenda de Agá between Itapemirim and Iriritiba Rivers; St. Agnes, Bahia, and along the coast); 1824a, pl. 83, figs. 1, 2; 1825, p. 519.—Peters, 1873a, p. 218.—Boulenger, 1882a, p. 351; 1885a, p. 196; 1886b, p. 444; 1888c, p. 416.—Boettger, 1892, p. 40.—Werner, 1894a, p. 413.—Goeldi, 1895, p. 89, fig. 1.—Berg, 1896, pp. 151, 211.—Brandes and Schoenichen, 1901, p. 403, fig. 1.—Gadow, 1901, p. 196.—Wandolleck, 1907, p. 13.—Baumann, 1912, p. 99.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 283.—Noble, 1926a, p. 15.—Miranda-Ribeiro, 1926, p. 91, fig. 52, pl. 9, fig. 2.—L. Müller, 1927, p. 265.—Mertens, 1928, p. 295.—deWitte, 1930a, p. 225.—Nicéforo-Maria, 1930, p. 104.—Mello-Leitão, 1937, pp. 111, 330.—Myers, 1946, pp. 14, 31.

1824. *Hyla geographica semilineata* Spix, p. 40, pl. 11, fig. 2 (type locality, Rio de Janeiro).

1841. *Hyla palmata* Duméril and Bibron (part), p. 544.—Burmeister, 1856, p. 102.

1858. *Hyla maxima* Günther (part), p. 99.—Reinhardt and Lütken, 1862, p. 183.—Hensel, 1867, p. 156.

Description.—Adult female, USNM 97451, Santa Alexandrina, city of Rio de Janeiro. Vomerine teeth in two very heavy, narrowly separated, /‾‾\-shaped patches between and behind the posterior borders of the choanae; tongue a little less than two-thirds the width of the mouth-opening, almost circular, with scarcely any indentation on its free posterior border; snout rather elongate, rounded when viewed from above and in profile, the upper jaw scarcely extending beyond the lower; nostrils more superior than lateral, only slightly projecting, their distance from end of snout about one-half that to eye, separated from each other by an interval equal to slightly more than one-half their distance from eye. Canthus rostralis blunt but well defined; loreal region concave, sloping greatly. Eye large, very prominent, its diameter two-thirds its distance from end of snout; interorbital diameter about 1⅓ times that of upper eyelid, greater than distance between nostrils. Tympanum very distinct, large, about three-fourths the diameter of the eye, separated from eye by an interval equal to about two-thirds its own diameter. Fingers one-third webbed, fourth much longer than second, reaching halfway upon disk of third which covers about one-half the tympanic area (in the male a pronounced pollex near base of first finger ending in an inward-curving, very sharp spur); toes slightly more than one-half webbed, third and fifth subequal, disk of fourth covering one-third of the tympanic area; a very pronounced oval inner but no outer metatarsal tubercle; a well-marked, narrow ridge along inside of tarsus; no dermal appendage on heel; body not elongate, rather massive, in postaxillary region slightly less than greatest width of head; when hind leg is adpressed, heel reaches considerably beyond snout; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to the body, heels greatly overlap. Skin of upper parts relatively smooth, but with many very narrow, long, glandular ridges anastomosing over the back; a glandular ridge encircling upper border of tympanum, narrow and faint above, becoming more prominent and wider behind and terminating behind the jawbone; skin of throat and chest very slightly granular, that of belly very coarsely granular, that of posterior and lower side of femur also heavily granular; no apparent skinfold across the chest. (Apparently a median external vocal sac in the male.)

Dimensions.—Head and body 87 mm.; head length 30 mm., width 34 mm.; femur 46 mm.; tibia 49 mm.; foot 35 mm.; hand 28 mm.

Color in alcohol.—Ground color of upper parts pale drab, with fawn color marblings on back and head; a narrow sepia line originating on the tip of the snout extending backwards and breaking up with spots on the middle of the back; a narrow diagonal black line behind the ear below the heavy posterior half of the glandular ridge; sides of body with many vertical, narrow, drab bars; tibia with about ten alternately wide and narrow olive crossbars; femur with similar but more widely spaced bars; outer part of femur clove brown; anal region seal brown, with a clove-brown line above it, preceded by a pale olive-gray area; outer surface of foot from heel to toe-tips and of arm from elbow to finger tips also seal brown, with a heavy border of clove brown adjoining a pale olive-gray streak; ventral surface uniform pale olive-gray except for some drab suffusions on under parts of limbs and on chin.

Color in life.—From a colored sketch by Sandig, without data. Dorsal ground color dull cream with a pale sepia median dorsal stripe and a few small sepia spots scattered irregularly on the back, upper eyelids, and limbs; femur with about a dozen rather narrow drab-gray bands on its upper and anterior surface; posteriorly these bands become wider and turn to heliotrope, with the interstices of the postfemoral ground color deep ochre yellow; forearm and tibia banded also with drab-gray; a black line down the outside of tibia; a plumbeous anal spot edged anteriorly with a narrow black and a white line; heel with a plumbeous black-edged spot, and a lighter one on the elbow; outer surface of tarsus olive-buff faintly mottled with gray, inner surface of tarsus ochre, the webs lighter, the disks of toes and fingers olive-gray; chin and chest pale olive-buff, belly and lower limb surfaces immaculate yellow ochre. Iris silvery cream color, the transversely elliptic pupil black.

A sketch of a very young specimen from Santa Alexandrina shows the upper head, back, forearm, and tibial surfaces to be pale olive-buff, with minute gray dots covering them, and a narrow sepia dorsal line and a few irregular sepia dots on the back; femur salmon-buff, with faint indications of darker crossbars; outer surface of tibia with a sepia line; a sepia patch on elbow, heel, and postanal region; feet and hands suffused with yellow ochre; chin, chest, and belly lilac-gray. Iris cream color. The adult male has a black or gray chin and throat.

Variations.—In a fine series of 21 grown individuals, there is not a great deal of variation as to structure. The tympanum at its greatest (vertical) diameter is between three-fifths and three-fourths the eye diameter and always appears very distinct. The eye diameter measures between five-eighths and three-fourths the distance from the eye to tip of snout, and the interorbital width is 1 to 1½ times that of the upper eyelid. The fingers are webbed from one-half to slightly more than one-third their length, while the toes are one-half to three-fourths webbed. The pattern is quite constant when present but the median dorsal sepia stripe is absent in about one out of five specimens. The glandules besetting the dorsal skin are microscopic, so that the back presents a very smooth appearance. The heel sometimes has a rather weak dermal ridge, and a tubercle is rarely present.

Remarks.—The chorus of singing males gives a booming metallic sound which seems at times to come with a regular clanging, like that of a blacksmith beating on an anvil. It begins early in the evening. The nests were seen in Santa Alexandrina, in the city of Rio de Janeiro, and at Covanca, near Jacarépaguá, not far from the city, as well as in Bello Horizonte, Minas Gerais. They were craterlike mud structures, round in shape, and perhaps 20 to 30 cm. in diameter, rising 5 to 10 cm. from the hollowed-out center where the eggs are laid. One adult was seen clinging to the edge of a nest, but whether it had just come to breed or was in the habit of "guarding" that particular nesting site I could not tell. In a very small area covered by an artificial pond in the florist's garden at Santa Alexandrina there were almost a dozen nests containing eggs at all the early stages. The nests were apparently built just at the water's edge, and some had been left a little above it by the lowering of the pond, but the next heavy rain would have sufficed to wash the young tadpoles into the pond. The retention of the egg-mass within the protecting mud walls just out of the water must serve to prevent the depredations of egg-eating fish. The effectiveness of this device and the hardihood of the species are indicated by the large numbers of adults. Eggs measuring 2 mm., taken from mud-nests at Santa Alexandrina, were developed sufficiently by the following day to hatch into small dark tadpoles 8 mm. long, the tail comprising 5 mm. of this length. Nine days later the tadpoles were about 13 mm. in length, with tails of 8 mm. A tadpole, USNM 97237, with fully developed fore and hind limbs, measures 90 mm. of which the tail is 55 mm. The largest in one series of tadpoles, USNM 96935, is 91 mm. in length, the still fully developed tail measuring 60 mm. and the fore limbs visible only under the skin.

The adults stay high in trees except at the time of egg laying. The male is said to come to the pond first to make the nest, then the female arrives to lay eggs.

Specimens examined

BRAZIL: BM RR 1936.13.3.110–112; UZMK 34, Lund.

Districto Federal: Rio de Janeiro, USNM 70539–40, Metcalf, Oct. 10, 1925; AMNH 17420, A. Lutz, 1922. Palmeiras, USNM 96397 (tadpole), November, 1923. Santa Alexandrina, USNM 97444–57, B. Lutz, Cochran, and Venancio, Feb 1, 1935. Tijuca, USNM 96240–1 (tadpoles).

Espírito Santo: ZSBS 59/1922, Bresslau, September 1913.

Minas Gerais: USNM 70537–8, Metcalf, Oct. 19, 1925. Bello Horizonte, USNM 96965, A. Lutz, December 1924; USNM 97896 (eggs), Cochran and Venancio, Mar. 13, 1935. Lagôa Santa, UZMK 36–37, 42–45, Warming; UZMK 253, Lund; UZMK 32–33, 35, Reinhardt.

Rio de Janeiro: Angra dos Reis, USNM 70535–6, Metcalf, Oct. 13, 1925. Barro Branco, MZUM 104182, Bailey, 1941. Caxias, USNM 98568, Pasarelli, Mar. 12, 1935. Colonia Alpina near Teresópolis, BM 94.5.23.13, Goeldi. Massambará, USNM 97234 (tadpole), A. Lutz, January 1920. Montserrat, Campo Bello, USNM 96935 (tadpoles), A. Lutz, Nov. 15–18, 1923. Petrópolis, KZAEM 2034, Ohaus, 1906. Pôrto Real, BM 87.12.29.-34–35 and 92.11.22.36, Hardy.

Rio Grande do Sul: BM 82.10.4.14, von Ihering. Mendes, MCZ 371 (part).

Santa Catarina: Hansa, KZAEM 2364–6, Erhardt, 1928; BM 1928.11.5.107, Erhardt. Humboldt, BM 1910.7.20.1, ZSBS 442/1920 (2), Erhardt. Nova Teutonia, Itá, USNM 103685, Plaumann, January 1938. Rio Humboldt, BM 1923.6.1.36, Fritsche.

Hyla langsdorffii Duméril and Bibron

Plates 6, Figures e–g, 34, Figure c

1841. *Hyla langsdorffii* Duméril and Bibron, p. 557 (type locality, Brazil).—Guichenot, 1855, p. 82, pl. 17, figs. 1, 1a.—Peters, 1872b, p. 771.—Boulenger, 1882a, p. 364; 1890, p. 325.—Baumann, 1912, p. 163.—**Nieden, 1923, p. 254.**

1843. *Hypsiboas langsdorffii* Fitzinger, p. 30.
1867. *Osteocephalus langsdorffii* Cope, p. 200.

Description.—Adult male, USNM 121337 Poá, São Paulo. Vomerine teeth in two very heavy, narrowly separated, short, transverse groups between the choanae and extending to behind their posterior borders; tongue two-thirds the width of mouth-opening, nearly round except for its slightly concave posterior rim, and nearly entirely attached; head with a pair of ridges from inner orbital border converging slightly towards occiput, on each side of which is a low transverse ridge marking the end of the skull; snout moderate in length, rounded when viewed from above, rounded and sloping backwards from edge of upper lip when seen in profile, the upper jaw slightly extending beyond the lower; nostrils dorsolateral, moderately projecting, their distance from end of snout one-half their distance from eye, separated from each other by an interval slightly smaller than their distance from eye. Canthus rostralis distinct but bluntly rounded, the loreal region concave, the upper lip flaring conspicuously outward below it. Eye large, very prominent, its diameter equal to its distance from nostril; interorbital diameter slightly greater than that of upper eyelid, 1½ times the distance between nostrils. Tympanum very distinct, moderate, about one-half the eye diameter, separated from eye by an interval equal to half its own diameter. Fingers one-half webbed, fourth much longer than second, reaching to center of disk of third, which covers the tympanum, a pronounced knob on inside of first finger; a scalloped glandular fold along outside of fourth finger extending to elbow; toes more than three-fourths webbed, third and fifth subequal, disk of fourth a little smaller than tympanum; a large oval inner and a very minute outer metatarsal tubercle; a few weak glandules marking the position of the inner tarsal ridge; a very heavy serrate outer tarsal ridge ending on heel. Body rather elongate, in postaxillary region narrower than greatest width of head; when hind leg is adpressed, heel reaches tip of snout; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts glandular, with many small and a few larger tubercles, the latter especially evident on sacrum and tibia; a heavy glandular ridge from eye to above and behind tympanum; a patch of tubercles behind anus, followed by a pair of heavy transverse postanal ridges of glandular skin forming "flaps," with a medium depression between them; throat and chest minutely granular, belly and lower thighs heavily granular; a transverse skinfold across throat marking presence of internal median vocal sac; no skinfold across chest apparent. The skin on top of the head is not ossified with the skull.

Dimensions.—Head and body 86 mm.; head length 27 mm., width 27 mm.; femur 41 mm.; tibia 46 mm.; foot 35 mm.; hand 26.5 mm.

Color in alcohol.—Dorsal ground color cream-buff; a very irregular wide russet blotch across the occiput and extending forward onto the eyelids, another across the lumbar region, both outlined with smaller black spots irregularly arranged; tip of snout with russet and black markings; femur with two narrow dark crossbars on its upper surface only, a similar bar on knee, two other crescent-shaped bars on upper tibial surface, and four or five others on tarsus and foot; posterior femur immaculate pale drab; venter pale cream, immaculate; upper lip pale russet, with some small dark spots along its margin; glandular ridge around tympanum edged with black; a black, wing-shaped preanal spot, and a network of fine black lines between the postanal tubercles; postanal "flaps" pale cream color.

Variations.—The additional specimens belonging to the Instituto Butantan agree extremely well in all essentials with the one just described. The smallest, IB 58, measuring 65 mm. in length, has the most pronounced postanal "flaps"; these are 2 mm. long and 5 mm. wide, extending well beyond the end of the body. The heel may extend to between nostril and tip of snout or considerably beyond the snout. The head width is equal to its length in all but one individual, where it is wider than long. The snout is half the length of the head. The tibia is from 50.7 to 55.0 percent of the total length, averaging 53.4. The irregular patches across head and lumbar region are less evident in some than in others, but the number of dark femoral bars is the same in these six specimens.

Remarks.—The type of *H. langsdorffi*, MNHP 4634, measures 93 mm. in head and body length. USNM 121337 was carefully compared with it. The two specimens were found to resemble each other very closely, as the type still plainly shows the many small tubercles on the back, the bony head, the long legs with squarish dark spots, and the dark reticulations around the anus.

Specimens examined

BRAZIL: NHMW 1160, 805, 1913, xix, Natterer; MHNP 4634 (type of *H. langsdorffii*), Langsdorff.

Bahia: ZMB 29-7488–9, Wucherer.

Espírito Santo or Minas Gerais: AMNH 38541, Kaempher, 1929.

Rio de Janeiro: Pôrto Real, BM. 92.11.22.29, du Dreneuf.

Santa Catarina: BM 88.11.30.5, von Ihering. Joinville, NHMW 1908–9.

São Paulo: Butantan, USNM 121338, IB 2. Poá, USNM 121337 (formerly IB 85), IB 58, 84, 559. Santos, ZMB 29-467, NHMW 1908a, Consul at Santos.

Hyla pardalis Spix

PLATE 6, FIGURES H–J

1824. *Hyla pardalis* Spix (part), p. 34, pl. 8, fig. 3 (type locality, Rio de Janeiro).—Peters (part), 1873a, p. 208.—Boulenger, 1882a, p. 354.—Werner, 1897a, p. 217.—Baumann, 1912, p. 100.—Beebe, 1919, p. 207; 1925, p. 124.—Nieden, 1923, p. 284.—L. Müller, 1927, p. 266.—A. Lutz, 1927, pp. 39–43.—Miranda-Ribeiro, 1926, p. 71, pl. 8, figs. 1–10.—Crawford, 1931, p. 33.—Schubart, 1939, p. 52.—Travassos, 1944, p. 128.

1856. *Hyla corticalis* Burmeister, p. 95, pl. 30, figs. 7–12 (type locality, Neu Freiburg [=Nova Friburgo], Rio de Janeiro).—Peters, 1872b, p. 771.—Boulenger, 1882a, p. 355.—Baumann, 1912, p. 163.—Nieden, 1923, p. 285.—Miranda-Ribeiro, 1926, p. 72, pl. 8, fig. 2.—Myers, 1946, pp. 13, 31.

1856. *Hyla* (*Centrotelma*) *lundii* Burmeister, p. 101, pl. 31, fig. 8 (type locality, Lagôa Santa, Minas Gerais).

1862. *Hyla pustulosa* Reinhardt and Lütken, p. 192 (type locality, Lagôa Santa, Minas Gerais).

1867. *Hypsiboas pardalis* Cope, p. 200.

Description.—Adult female, USNM 81128, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two very heavy, narrowly separated, short /‾ ‾\ shaped patches between the posterior borders of the choanae; tongue about one-half the width of mouth-opening, almost oval, with a slight indentation on its partly free posterior border; snout very short and broad, rounded when viewed from above, truncate and slanting backwards from the edge of the upper lip when seen in profile, the upper jaw scarcely extending beyond the lower; nostrils lateral, projecting greatly, their distance from end of snout about one-half that from eye, separated from each other by an interval almost as great as their distance from eye. Canthus rostralis blunt but well defined; the loreal region concave, the upper lip flaring conspicuously outward below it. Eye large, very prominent, its diameter almost equal to its distance from end of snout; interorbital diameter 1⅓ times that of upper eyelid, considerably greater than distance between nostrils. Tympanum very distinct, large, about two-thirds the diameter of eye, separated from eye by an interval equal to about one-fourth its own diameter. Fingers entirely webbed, fourth a little longer than second, reaching to disk of third, which covers two-thirds the tympanic area; a very pronounced pollex visible as a knob on inside of first finger; a very heavy, serrate, glandular fold along outside of forearm and hand; toes somewhat more than three-fourths webbed, fifth a little longer than third, disk of fourth covering about two-thirds the tympanic area; a large oval inner but no outer metatarsal tubercle; a smooth sharp ridge along inside of tarsus, and a heavy, serrate, glandular fold beginning on the foot, extending along outside of tarsus, crossing the heel at right angles and continuing reduced in size along inside of tibia; a pronounced dermal appendage on heel arising on this glandular fold. Body heavy, not elongate, in postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow just touch; when hind legs are bent at right angles to body, heels slightly overlap. Skin of upper parts minutely glandular, the glandules most evident on limbs above tympanum and on posterior part of back, and forming a few faint diagonal ridges on center of back; a very heavy glandular ridge above and behind tympanum; a pair of heavy, short, serrate glandular ridges below the anus, with a median depression between them, the area around them very glandular; chin and chest faintly granular, belly and lower part of femur heavily granular, with three small tubercles near the glandular postanal ridges; apparently no skinfold across the chest. (A median external vocal sac in the male.)

Dimensions.—Head and body 61 mm.; head length 20 mm., width 22 mm.; femur 29.5 mm.; tibia 31 mm.; foot 27 mm.; hand 18.5 mm.

Color in alcohol.—Dorsal ground color dull cream-buff; an indistinct narrow sepia line beginning on tip of snout, running below the nostrils and the canthus rostralis, continuing on the heavy glandular ridge above the tympanum and fading out on the shoulder; some diagonal sepia spots on upper lip; a series of fine, paired, parallel sepia bars on the sides of the body, the upper parts of the bars merging and forming an indistinct, backward-pointing mark over the sacral hump; a few small irregular sepia blotches on anterior back and on head; limbs with wide dark crossbars above, these dark markings becoming fine and almost hairlike on the anterior and posterior surface of femur; a dark postanal patch; ventral surface immaculate dull cream.

Variations.—Five adults and a half-grown frog from Minas Gerais show a less extensive webbing of the hand than does the described specimen; four of these, including the young frog, have the fingers only one-half webbed, while the two remaining have them two-thirds webbed. The example of *H. corticalis* Burmeister, ZMB 7490, from Bahia, is like the described specimen, from the State of Rio de Janeiro, in possessing fully webbed fingers. The leg length of *H. pardalis* is variable, the adpressed heel extending to the nostril in two examples only, to end of snout or beyond it in the others (in the Bahia example of *corticalis* it reaches considerably beyond). The tympanum of *pardalis* measures a little over half to almost three-fourths the eye diameter. The snout is usually rather blunt, with eye diameter equalling its distance from end of snout, but sometimes longer. The dermal characters are very constant in all the specimens at hand, although the degree of development of the heel tubercle (sometimes lacking) and the serrations along the outside of tarsus differ among individuals. A pronounced rudiment of a pollex occurs in the male example of *corticalis*, as it does in the male examples of *pardalis;* thus, one of the characters supposedly separating *pardalis* and *corticalis* disappears and the latter can properly be considered a synonym of the former (and earlier) name. The presence of a pollex is apparently a characteristic of the male *pardalis*, as the specimen figured by Burmeister, probably a female, lacks it. The anal ridges are very prominent in the Berlin Museum *corticalis* and all the examples of *pardalis* in the U. S. National Museum.

A very young frog from Marianna, Minas Gerais, MP 704 (part), measuring only 23 mm. in head and body length, is easily recognizable by the same structural features that characterize the adult—the serrate glandular fringe on outer forearm and tarsus and particularly the pair of semilunar postanal glands, which stand out beyond the outline of the femur. The eye in so young an individual appears large, almost equalling the distance from its anterior border to the end of the snout; the tympanum is small, less than half the eye diameter, and seems rather distant from the eye; the vomerine teeth are slender but distinct; and the color pattern is almost faded out, except for a narrow dark line below the canthus, some indistinct dark blotches in the dorsaloteral region, and a few indications of crossbars on forearm, tibia, and foot.

Specimens examined

BRAZIL:

Bahia: Bahia, ZMB 7490; USNM 75987, de Lacerda.

Districto Federal: Rio de Janeiro, ZSBS 2499 (cotype of *H. pardalis*), Spix; ZSBS 59/47, A. Lutz, 1932.

Espírito Santo: Mimoso, ZSBS 723/29 (2); Bresslau, 1913.

Minas Gerais: Agua Limpa, Ouro Prêto, USNM 96990–1, A. Lutz, August 1921; AMNH 17417–8, A. Lutz, 1922. Lagôa Santa, UZMK 10 (type of *Hyla pustulosa*), Reinhardt, Oct. 1, 1856; UZMK 11, Warming, Oct. 24, 1866. Marianna, MP 704 (part). São João d'El Rey, USNM 97204–7, A. Lutz, 1929.

Rio de Janeiro: Barro Branco, MZUM 104173 (7); Bailey, 1941. Campo Bello, ZSBS 221/25, A. Lutz, 1923; ZMB 29488, A. Lutz. Fazenda do Cachoeira, UZMK 342, Böving-Petersen, 1892. Merity, IOC, Pasarelli, November 1935. Nova Friburgo, USNM 104308, B. Lutz, February 1937. Petrópolis, NHMW (3), Főtterle and Post. Serra da Bocaina, USNM 81128, A. Lutz, January 1930. Teresópolis, BM 1914.3.20.8, Hill; ZMB 29495, Miranda-Ribeiro. Valença, IB 62.

São Paulo: Piquete, BM 1907.7.29.27–28, Robert.

3. *albopunctata*—group

In southeastern Brazil occur seven allied forms—*albopunctata*, *bischoffi multilineata*, *claresignata*, *clepsydra*, *polytaenia*, *raddiana raddiana*, and *raniceps*—separated from the species of *Hyla* in other groups by their more streamlined body shape, by lacking an outer metatarsal tubercle, and by having the fingers webbed only at the base in all except *claresignata*, in which the fingers are less than one-third webbed. These frogs are moderate to quite large in size, but their agility makes them difficult to catch. The greatest range is that of *albopunctata*, which is found from French Guiana to São Paulo; *raniceps* occurs from northern Brazil to Paraguay, *raddiana raddiana* is known from São Paulo to Argentina, and *polytaenia* occurs from Minas Gerais to Santa Catarina. The remaining species are so rare in collections that they are known at present only from a limited area near their respective type localities.

For a statistical analysis of measurements of members of the *albopunctata* group here discussed, see pages 373 and 376.

Key to frogs of Group 3 in southeastern Brazil

a^1. Fingers nearly ⅓, toes ¾ webbed; dorsum pale yellowish, with a series of light-edged dark spots on the sides and femur; a dark postanal patch. **claresignata** (p. 86)

a^2. Fingers webbed only at the base.

b^1. Snout elongate, upper jaw projecting considerably beyond lower; adpressed heel reaching well beyond tip of snout.

c^1. Toes ½ webbed; nostrils ½ as far from tip of snout as from eye; posterior femur bluish, with scattered, round, yellow spots. **albopunctata** (p. 80)

c^2. Toes ¾ webbed; nostrils ⅔ as far from tip of snout as from eye; posterior femur with 7 to 9 heavy slate-colored bands forking below. **raniceps** (p. 96)

b^2. Snout not conspicuously elongate, upper jaw not projecting much beyond lower; toes ½ webbed.

c^1. Diameter of eye equal to its distance from tip of snout; dorsum with alternately wider and narrower stripes, these sometimes broken up into longitudinal series of spots; a wide, dark lateral stripe. **polytaenia** (p. 89)

c^2. Diameter of eye somewhat less than its distance from tip of snout.

d^1. Tympanum very small, about ⅓ of eye diameter; dorsum with a dark hourglass-shaped blotch beginning on the eyelids and extending to the sacrum . . . . **clepsydra** (p. 87)

d^2. Tympanum ½ diameter of eye.

e^1. Pollex very pronounced; heel reaching to tip of snout; dorsum with many fine, dark, parallel lines . . . **bischoffi multilineata** (p. 84)

e^2. Pollex slight; heel reaching to anterior border of eye; dorsum not striped; an irregular dark lateral stripe bordered with a light edge above . . . . **raddiana raddiana** (p. 93)

***Hyla albopunctata* Spix**

Figure 9

1801. *Hyla boans* (not of Linnaeus) Latreille, p. 184.—Daudin, 1802, p. 31, pl. 11; 1803, p. 64.—Duméril and Bibron, 1841, p. 605.—Burmeister, 1856, p. 108.—Günther, 1858, pp. 102, 146, pl. 8, fig. D.—Boulenger, 1882a, p. 360.—Peracca, 1904a, p. 13.—Baumann, 1912, p. 102.—Beebe, 1919, p. 208; 1925, p. 125.—Ruthven, 1919, p. 13.—Nieden, 1923, p. 307.—Miranda-Ribeiro, 1926, p. 84, fig. 49.—Parker, 1928, p. 98; 1935, p. 511.—Crawford, 1931, p. 34.—Crawford and Jones, 1933, p. 90.—Carvalho, 1939a, p. 279.—Schubart, 1939, p. 51.—Mertens, 1940, p. 195.—Travassos and Freitas, 1942, p. 282.
1824. *Hyla albopunctata* Spix, p. 33, pl. 6, fig. 5 (type locality not given).—Peters, 1873a, p. 207.—Andersson, 1900, p. 17.—Shreve, 1935, p. 211.
1830. *Auletris boans* Wagler, p. 201.
1838. *Hypsiboas boans* Tschudi, p. 72.
1858. *Hyla multifasciata* Günther, p. 101, pl. 8, fig. D (type locality, Pará).
1862. *Hyla oxyrhina* Reinhardt and Lütken, p. 189 (type locality, Lagôa Santa, Minas Gerais).—Cope, 1863, p. 48.
1867. *Hypsiboas albipunctatus* Cope, p. 201.

Description.—Adult male, USNM 97887, Bello Horizonte, Minas Gerais. Vomerine teeth in two moderately heavy /‾‾\-shaped patches between and behind the posterior borders of the choanae; tongue slightly more than one-half the width of mouth-opening, distinctly elongate, with a slight indentation on its posterior border, which is scarcely free; snout quite elongate, slightly pointed when viewed from above and in profile, the upper jaw projecting considerably beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about one-half that from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis blunt but well defined, loreal region slightly concave, nearly vertical. Eye rather large, its diameter almost equal to its distance from end of snout; interorbital diameter equal to that of upper eyelid, slightly less than distance between nostrils. Tympanum distinct, large, about two-thirds the diameter of the eye, separated from eye by an interval equal to about one-third its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching to base of disk of third, which covers about one-fourth the tympanic area; a very slight rudiment of a pollex; toes one-half webbed, third and fifth subequal, disk of fourth very small, covering only about one-sixth the tympanic area; a small, distinct inner but no outer metatarsal tubercle; a very faint ridge along inside of tarsus and a slightly more pronounced one on outside of tarsus extending onto the heel but not forming a dermal appendage; body rather elongate and moderately slender, width in postaxillary region slightly less than greatest width of head; when hind leg is adpressed, heel reaches considerably beyond tip of snout; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to the body, heels considerably overlap. Skin of upper parts very minutely glandular; a distinct glandular ridge beginning behind the eye, extending along the upper border of the tympanum and straight back to the level of the axillae where it disappears; skin of chin smooth, of throat very minutely granular, of abdomen and lower thighs coarsely granular; a very heavy skinfold across the chest; a low glandular transverse ridge in front of anus, and a double median postanal series of glands, each extending at a right angle outward along the lower femur as a row of enlarged glands. A large median external vocal sac.

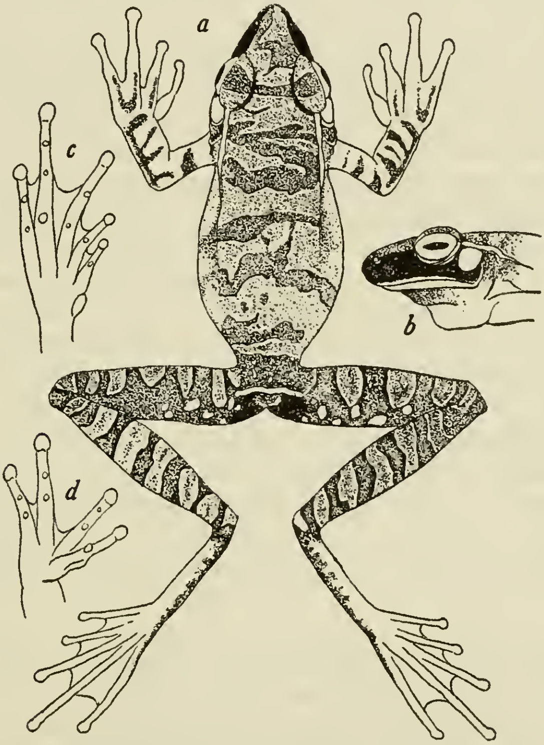


Figure 9.—*Hyla albopunctata*, USNM 97887: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × 1.

Dimensions.—Head and body 54 mm.; head length 18 mm., width 16 mm.; femur 29 mm.; tibia 30 mm.; foot 22.5 mm.; hand 15 mm.

Color in alcohol.—Body color above drab, with numerous light-edged seal-brown irregular crossbars from snout to anal region, these bars extending down onto the sides and being separated by light spots; anal region with a white line following the glandular ridge above it and a series of light dots on the median postanal double series of glands; arms and legs heavily crossbarred, the posterior surface of the femur with several scattered round white spots; a white line beginning on the heel, extending along the outside of the tarsus and along the fifth toe; a similar one from elbow to outer finger; a wide brown streak originating at the tip of the snout, covering the whole of the loreal region, extending across and behind the ear and fading out behind the shoulder; upper and lower lips with a narrow sharply outlined white border; chin below this white border sepia, fading out to wood brown on throat and chest, the remainder of the body and lower limb surfaces being slightly paler and immaculate.

Color in life.—From a sketch without data by Sandig. Light phase: Dorsal ground color ochre yellow with irregular, very faint, wide, drab-gray crossbars, 3 or 4 across the head, 7 or 8 across the body and sometimes breaking up or anastomosing; similar but more regular pale gray crossbars on upper surfaces of arms and legs; posterior surface of femur campanula blue, with about 10 round black-edged chrome-yellow spots arranged diagonally in pairs, the blue fading out into the pale gray crossbars on upper surface of femur; groin pale dull blue; a narrow seal-brown line beginning at the nostrils, running below the canthus rostralis, continuing over the ear and fading out on the sides; a narrow chrome-yellow line above this dark line; a transverse chrome-yellow line above anus followed by a dark anal patch; outer surface of forearm and tibia suffused with brown, heel also brown; a narrow yellow line along outside of tarsus. Sides of body spotted with yellow. Ventral surface pinkish buff on chin to maize yellow on belly, with suffusions of raw sienna on lower femur and tibia; hands and feet olive-buff, below immaculate. A double row of median postanal white spots marking the postanal series of glands. Iris cinnamon to russet, finely dotted with yellow towards the iris, which is black and transversely elliptic.

Dark phase: Dorsal ground color vinaceous-cinnamon, with faint, irregular, transverse darker markings; posterior lateral region, groin, and anterior and posterior femoral surfaces dark sepia, with round black-edged yellow spots as in the light phase. A wide clove-brown stripe from nostrils along loreal region and continuing part way down the sides of the body.

Variations.—In the series of 26 examples of this beautiful species, certain features show considerable variation. The adpressed heel, for instance, reaches in two or three instances only midway between eye and nostril, in a majority of cases a little beyond the end of the snout, but in some cases far beyond it. The tibiae of two specimens of equal size may vary in length, and when limbs are laid along the sides, knee and elbow may or may not meet. The snout is very definitely prolonged in most examples, in a few it is almost attenuate in its extreme length, while in the smaller and younger specimens it is more rounded and shorter. The webbing and length of fingers and toes do not vary much, and the heavy vomerine teeth and the elongate notched tongue are also quite characteristic of every specimen. The color pattern is subject to only slight changes, except that of a dark ground color to a pale one. The darker irregular transverse dorsal stripes may be wide or narrow, but the distinctive dark area along the loreal region and above the shoulder is a constant feature, as are the light round spots on the posterior femur and around the groin. The elongate snout gives the species almost the appearance of a *Leptodactylus*. It is one of the easiest of all Brazilian hylids to recognize.

Some examples identified as *H. albopunctata* (MZUM) from British Guiana have the posterior femur dark and immaculate. Neither Boulenger nor Nieden mention the presence of spots on the posterior femur. As these seem to be uniformly present in all the Brazilian specimens at hand, it may be possible to separate the northern form as a subspecies if the lack of spotting proves to be constant.

Remarks.—A frog from São Paulo, ANS 14105, formerly identified as *Hyla punctata*, is apparently *H. albopunctata*. With the amount of variation evident in the specimens of *albopunctata* I have examined, it is obvious that the specific distinctions mentioned by Boulenger and Nieden are insufficient to separate the two species. Only a careful comparison of individuals of the original material on which the two names are based can determine satisfactorily whether or not the two forms are distinct.

This species was found near the Country Club not far from Bello Horizonte in Minas Geraís, in a moist meadow where the seepage from a dam made the spot very boggy. It was not as active as most of its relatives, and was caught rather easily at night by holding a flashlight in front of its face. It was likewise taken at night in the aquatic plants bordering Lagôa Santa. Its voice consists of two strong, high-pitched notes *jwah, jwah,* followed by a low guttural *aw.* Adults usually are found in the water on lily leaves, and not as a rule in banana trees. No eggs are known. The two metamorphic young from Lassance (USNM 98126–7) were light green with darker median spots on the middorsal region when first collected.

H. albopunctata can be confused with descriptions of *H. crepitans,* but in reality the two species are not closely related, as *albopunctata* has a much more elongate snout, smaller disks, and a particular color pattern not found in true *crepitans.*

Specimens examined

BRAZIL:

Minas Gerais: Bello Horizonte, Country Club grounds, USMN 97887–90, Lisboa, Cochran, and Venancio, Mar. 13, 1935. Lagôa Santa, USNM 97983–8, Lisboa, Cochran, and Venancio, Mar. 14, 1935; UZMK 4, 19 (type of *Hyla spectrum*), 22 (type of *H. oxyrhina*), 23–5, Reinhardt, 1847; UZMK 28, Warming. Lassance, Santa Rita, USNM 98788–99, Dias, Mar. 30–31, 1935; USNM 98126–7, Lagôa do Curralinho, Cochran, Dias, and Venancio, Mar. 21, 1935.

Pará: BM 51.12.26.4 (type of *H. multifasciata*), Stevens collection. Marajó, MHNP 478B, Jobert.

Rio de Janeiro: ZSBS (2), A. Lutz, 1926. Entre Rios, AMNH 17402–3, A. Lutz, 1922; Fazenda Floresta, USNM 97217, Venancio. Formosa, Serra da Bocaina, USNM 96902–4, A. Lutz, Jan. 16–30, 1925. Nova Friburgo, USNM 104309–10, B. Lutz, February 1937.

São Paulo: Botafogo, USNM 121343. Butantan, IB 110. Capital, IB 580. Dois Córregos, IB 74; MHNP 50-248 (8), Della Serra. São João do Rio Negro, ANS 14105, H. H. Smith. Valença, IB 62.

FRENCH GUIANA: MHNP 479, Leschenault. Cayenne, MHNP 480, Leprieur; UZMK 29.

SURINAM: UZMK 20.

Hyla bischoffi multilineata Lutz and Lutz

Figure 10

1939. *Hyla multilineata* Lutz and Lutz, 1939a, p. 72 (type locality, Alto da Serra, São Paulo).

Description.—Adult male, USNM 96794, Alto da Serra, São Paulo. Vomerine teeth in two short, heavy, transverse, narrowly separated series just behind the posterior borders of the choanae; tongue slightly more than one-half the width of mouth opening, cordiform, slightly notched on its free posterior border; snout moderate in length, slightly pointed when viewed from above, rounded in profile, the upper jaw scarcely extending beyond lower; nostrils distinctly lateral, prominently projecting, their distance from end of snout about two-thirds that to eye, separated from each other by an interval equal to a little less than their distance from eye. Canthus rostralis sharp and very prominent; loreal region flat and nearly vertical, with upper labial border jutting out sharply below it. Eye large, very prominent, its diameter slightly less than its distance from end of snout; interorbital diameter somewhat greater than width of upper eyelid, slightly greater than distance between nostrils. Tympanum very distinct, equal to one-half the diameter of eye, separated from eye by an interval equal to about one-third its own diameter. Fingers webbed only at the base, fourth longer than second, reaching nearly to disk of third which covers about two-thirds the tympanic area; a very pronounced knoblike rudiment of a pollex; toes one-half webbed, fifth slightly longer than third, disk of fourth covering two-thirds the tympanic area; a small tuberclelike inner but no outer metatarsal tubercle; a low but distinct inner tarsal ridge; a small tubercular dermal appendage on heel (in this individual). Body rather elongate, in postaxillary region somewhat narrower than greatest diameter of head; when hind leg is adpressed, heel reaches to tip of snout; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts quite smooth; a pronounced glandular ridge beginning in front of ear, continuing above it and along the dorsolateral region midway to groin; skin of throat faintly granular; skin of chest and belly very finely granular; lower part of femur also finely granular; no apparent skinfold across the chest. No external vocal sac apparent (?).

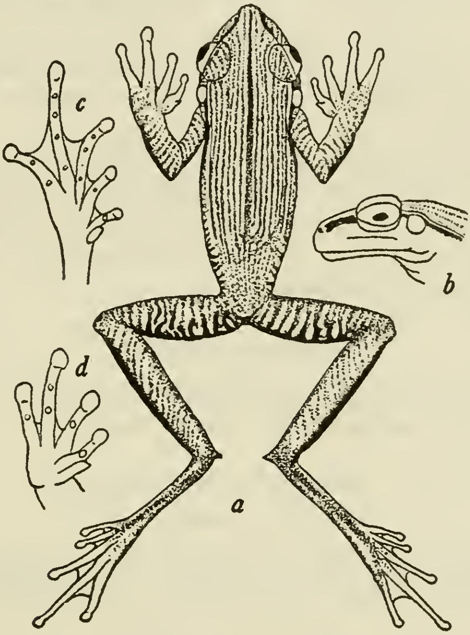


Figure 10.—*Hyla bischoffi multilineata*, USNM 96794: *a*, Dorsum × ½; *b*, profile × ½; *c*, foot × ¾; *d*, hand × ¾.

Dimensions.—Head and body 42 mm.; head length 15 mm., width 14 mm.; femur 20 mm.; tibia 25 mm.; foot 17.5 mm.; hand 13 mm.

Color in life.—From a sketch by Sandig of a specimen of *H. multilineata* from the type locality. Dorsum pea green with suffusions of sulphur yellow on head; limbs lighter; many fine longitudinal gray lines more or less parallel on anterior part of body, curving and marbled on posterior part; similar but paler gray lines running diagonally on upper lip and transversely on upper limb surfaces; a black dorsolateral line beginning at the tip of snout, continuing above the shoulders, and fading out at midbody; inside of elbow, groin and anterior and posterior femur, inside of tarsus and foot geranium red, lighter on base of webs between toes; posterior half of lateral region with narrow, vertical black bars; posterior surface of femur with similar but coarser light-bordered black bars; outside of tibia with a black, yellow-bordered stripe; heel, elbow, and anal region with black, light-edged patches. Chin straw yellow; belly olive-buff; lower parts of fore limbs pearl gray, of hind limbs pale geranium red; disks of toes and fingers pale olive-buff above and below. Iris dull straw yellow at the center, olive at the periphery; pupil black, transversely elliptic.

Remarks.—Although both forms of *H. bischoffi* are closely related to *H. raddiana*, an examination of the head alone is usually sufficient to separate the two species, as the flaring upper lip and broad head of *bischoffi* are quite unlike the nearly vertical loreal region and relatively narrow head of *raddiana*.

Specimens examined

BRAZIL:

São Paulo: Alto da Serra, USNM 96784–93 (cotypes), A. Lutz, 1922–23; USNM 102281. São Paulo, USNM 96857, Castro.

Hyla claresignata Lutz and Lutz

Plate 7, Figure a

1939. *Hyla claresignata* Lutz and Lutz, 1939a, p. 67 (type localities, Teresópolis and Serra da Bocaina, Rio de Janeiro).—Lutz and Orton, 1946, pp. 1–20, figs. 1–15.—B. Lutz, 1949c, p. 747, figs. 1–6.

Description.—Male, IOC (cotype), Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two oblique well separated patches between the posterior choanal borders; tongue flattened and very wide, over four-fifths the width of mouth opening, scarcely free behind; snout short, slightly truncate at the tip when seen from above and in profile; the upper jaw projecting a little beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about one-third their distance from eye, separated from each other by an interval nearly equal to their distance from eye. Canthus rostralis rounded, distinct, loreal region concave and sloping. Eye large, prominent, its diameter equal to its distance from tip of snout; interorbital diameter equal to width of upper eyelid, which is nearly equal to the distance between nostrils. Tympanum very small but distinct, about one-third the diameter of eye, separated from eye by an interval of more than 1½ times its own diameter. Fingers not quite one-third webbed, fourth much longer than second, reaching to base of disk of third, which nearly covers the tympanum; a well developed pollex equipped with a small but very sharp spur; toes nearly three-fourths webbed, third a little shorter than fifth; toe disks small, that of fourth covering the small tympanum completely; a distinct inner but no outer metatarsal tubercle; a distinct inner tarsal ridge, and a similar glandular ridge crossing heel above the dark heel patch. Body rather elongate, in postaxillary region much narrower than greatest width of head. When hind leg is adpressed, heel reaches between eye and nostril; when limbs are laid along the body, knee and elbow overlap; when hind legs are bent at right angles to body, heels overlap. Skin of dorsum uniformly smooth; a glandular ridge encircling tympanum, extending diagonally downwards and ending behind arm above axilla; throat fairly smooth, chest and belly and lower femur coarsely granular; no apparent skinfold across chest. A very large vocal sac extending entirely across the throat and almost to the ears.

Dimensions.—Head and body 41 mm.; head length 14 mm., width 15 mm.; femur 16 mm.; tibia 21 mm.; foot 22 mm.; hand 20 mm.

Color in alcohol.—This specimen has faded badly. There are still visible 3 narrow dark lines crossing the upper femur, whose posterior surface is immaculate, and a few irregular dark patches on upper tibia.

Color in life.—From original description: Dorsum maize yellow with numerous gray dots. Sides of body, concealed parts of legs, arms, and webs chrome yellow; venter paler; a series of irregular clove brown, white-margined dorsolateral spots continuing on upper femur and anal region.

Hyla clepsydra **A. Lutz**

PLATE 7, FIGURE B

1925. *Hyla clepsydra* A. LUTZ, 1925b, p. 211 (type locality, Serra da Bocaina); 1926a, pp. 6, 13.

Description.—Adult male, IOC (type), Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two exceedingly heavy, long, transverse, well separated series behind the posterior level of the choanae; tongue slightly less than two-thirds as wide as mouth-opening, widely oval, almost entirely attached behind and with scarcely a trace of an indentation; snout moderately short, rounded at the tip when viewed from above, truncate in profile, the upper jaw projecting only slightly beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about half that to anterior border of eye, separated from each other by an interval about equal to their distance from eye. Canthus rostralis distinct but rounded; loreal region concave and sloping. Eye large, prominent, its diameter slightly less than its distance from end of snout; interorbital diameter about 1¼ times the width of upper eyelid, which is relatively wide, greater than distance between nostrils. Tympanum very small but distinct, about one-third the diameter of the eye, separated from eye by an interval equal to about 1⅔ times its own diameter. Fingers webbed at the base, fourth much longer than second, reaching to disk of third, which practically covers the tympanic area; a pollex with a very sharp needlelike spur projecting from the side of the first finger; toes one-half webbed, third apparently shorter than fifth, disks very small, that of fourth toe apparently covering only one-half the tympanic area; a very prominent inner but no outer metatarsal tubercle; no tarsal ridge; no dermal appendage on heel. Body rather elongate, in postaxillary region considerably narrower than greatest diameter of head. When hind leg is adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow apparently just touch; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts smooth; a heavy glandular ridge encircling tympanum and ending on shoulder; skin of throat and chest smooth, of belly and postanal region coarsely granular, of lower femur almost smooth; no apparent skinfold across the chest. A pair of lateral external vocal sacs.

Dimensions.—Head and body 39 mm.; head length 14 mm., width 14 mm.; femur 17 mm.; tibia 22 mm. (The forearm is very greatly developed and the upper arm rather weak. It is almost impossible to straighten the arm to allow measuring.)

Color in alcohol.—The badly faded and mutilated specimen described shows no trace whatever of its original color pattern, being now an immaculate drab over its entire surface.

Color in life.—From a sketch of type by Sandig. Dorsal ground color primrose yellow to cream color; a large, longitudinal, hourglass-shaped, black-edged sepia mark on the back, its anterior borders extending onto the eyelids, narrowing above the shoulders, widening at the center of the back, and having a posterolateral extension at the sacrum; lateral region immaculate; a small sepia spot on tip of snout, and apparently a sepia stripe along the loreal region; femur deep flesh color, immaculate on its anterior and posterior surfaces but with faint traces of sepia crossbars showing on its upper surface; tibia and forearm cream color, with much heavier dark crossbands; top of foot pale flesh color with traces of sepia; a seal-brown anal patch; a black spot on the heel. Iris tawny olive, the pupil black and transversely elliptic.

Remarks.—There is a marked similarity of structure between the type of *H. clepsydra* and examples of *H. bischoffi multilineata*. While the color patterns of the two species are notably different in most features, details of structure definitely lead to the conclusion that the two are allied. The very small tympanum of the type of *clepsydra*, one-third the eye diameter, is often paralleled in the large series of *multilineata*, in which the tympanum may be as great as one-half the eye diameter but is sometimes much smaller, so that the finger disk practically covers it as has already been noted in variation in *multilineata*. In the contour of the head, the shape of the snout, and the manner in which the prominent eyes are set upon the head, the similarities become quite apparent when actual specimens are compared. The vomerine teeth are also much the same. An important characteristic not found often, except in larger frogs, is the prominent rudiment of a pollex, noticeable equally in *clepsydra* and in all male examples of *multilineata*. This at once places the two species in a more than accidental juxtaposition. Furthermore, the limb proportions coincide. The similarities in color pattern, as seen in the water color sketch by Sandig of the living frog, seem to be the dark patches behind anus and on heel, the dark loreal region, and the narrow brown bars across the upper surface of the femur. A significant fact, however, is that the anterior and posterior femoral surfaces and top of foot of both species are pink or red, a condition not too frequently found in species of *Hyla*. The hourglass-shaped dorsal marking which characterizes *clepsydra* is not approached by any individuals in the series of *multilineata*, and it seems well to keep the two species separate until a larger series of *clepsydra* can be brought together for full variational studies.

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, IOC (type; from bromeliad); IOC (1), A. Lutz, December 1928.

Hyla polytaenia **Cope**

Plate 7, Figures c–g

1869. *Hyla rubicundula* (not of Reinhardt and Lütken) Günther, p. 489, pl. 40, fig. 3.

1870. *Hyla polytaenia* Cope, 1870, p. 164 (type locality, Brazil); 1871a, p. 554.—Boulenger, 1882a, p. 394.—Goeldi, 1895, p. 93.—Gadow, 1901, p. 198.—Baumann, 1912, p. 107.—Nieden, 1923, p. 293.—Miranda-Ribeiro, 1926, p. 83.—L. Müller, 1927, p. 266.—Barbour and Loveridge, 1929, p. 280.—deWitte, 1930a, p. 228.—Myers, 1946, pp. 13, 31.

1872. *Hyla striata* Peters, 1872a, p. 681 (type locality, Nova Friburgo, Rio de Janeiro).

1925. *Hyla semiguttata* A. Lutz, 1925b, p. 212 (type locality, São Bento, Santa Catarina); 1926a, pp. 7, 14.

Description.—Young female, USNM 98024, Agua Limpa, Ouro Prêto, Minas Gerais. Vomerine teeth in two short, heavy, transverse, widely separated series behind the choanae; tongue two-thirds the width of mouth opening, almost circular, with a very slight indentation on its partially free posterior margin; snout relatively short, rounded when viewed from above and in profile, the upper jaw extending somewhat beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about one-half that to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis blunt but well defined, loreal region concave, nearly vertical. Eye large, prominent, its diameter equal to its distance from end of snout; interorbital diameter very slightly greater than that of upper eyelid, slightly greater than distance between nostrils. Tympanum very distinct, medium-sized, about one-half the diameter of the eye, separated from eye by an interval equal to its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching halfway on disk of third which covers almost the entire tympanic area; no pronounced rudiment of a pollex; toes one-half webbed, fifth somewhat longer than third, disk of fourth covering three-fourths the tympanic area; a pronounced oval inner but no outer metatarsal tubercle; a very faintly indicated ridge along inside of tarsus; no dermal appendage on heel but a distinct ridge across it (often ending in a small tubercle); body elongate, in postaxillary region narrower than greatest width of head; when hind leg is adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow just touch; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts quite smooth; a slight glandular ridge extending along upper border of tympanum and ending in front of shoulder; skin of throat and chest smooth, that of belly coarsely granular, that of underside of thighs more finely granular; no apparent skinfold across the chest. (Apparently a median vocal sac in the male.)

Dimensions.—Head and body 37 mm.; head length 11 mm., width 11 mm.; femur 17 mm.; tibia 18 mm.; foot 15 mm.; hand 11 mm.

Color in alcohol.—Ground color of upper parts pale olive-buff; a sepia stripe beginning at the nostrils, continuing behind the ear across the tympanum where it is widest, then narrowing and gradually fading out as it reaches the groin; a median series of drab spots representing a median stripe from tip of snout to anus; on each side of this a row of very small spots, then a row of large ones, then another row of very small ones, so that between the sepia lateral stripes there are seven alternately wide and narrow longitudinal stripes, in this instance reduced to a series of spots; upper surfaces of limbs with rows of small drab dots, outer limb surfaces with a wider sepia stripe; posterior surface of thigh immaculate; anal region sepia, with a light horizontal line above it; upper lips and also sides of chin with narrow drab longitudinal lines; remainder of ventral surface immaculate cream buff.

Color in life.—From sketch by Pugas of specimen from Itatiaia, Rio de Janeiro. Dorsal ground color cream; a vandyke-brown median dorsal stripe beginning on top of snout and continuing to anus; another brown stripe beginning on the eyelid and paralleling the median one almost to the anus; a brown lateral stripe beginning on the tip of the snout, widening on the loreal region, and continuing on the sides to the groin; a number of small brown dots in linear arrangement on the light areas of the posterior back, and some small light dots within the brown stripes; anterior and posterior surface of femur ochraceous-buff, with a definite cream-color stripe running along its upper surface; forearm and tibia striped with russet on outer and inner surfaces, cream above, with a series of minute brown dots along the cream stripe on the tibia; inside of tarsus and foot pale rufous, the outer parts including webs and disks cream color; a narrow wavy brown line edging anus in front. Iris saffron yellow, with fine black reticulations; pupil black, transversely elliptic.

Variations.—Among 17 half-grown and adult frogs from Bonito, Serra da Bocaina, some variation is to be seen in the length of the snout, as it is sometimes longer than the eye diameter in the larger females. While the heel reaches to the anterior border of the eye and often to tip of snout, in the large male, USNM 81126, it reaches barely to the center of the eye. The webbing between the fingers is often slight, but sometimes extends to nearly one-third their length. The heel ridge may sometimes develop into a rather blunt tubercle. The vomerine teeth, always heavy and distinct, may be between the posterior borders of the choanae, or slightly behind this level. The tympanum shows the usual variation found in most other species of frogs, sometimes a little more than one-half the eye diameter, occasionally a little less.

The greatest variation, however, comes in the color pattern, since it changes as the frog grows. In the youngest individuals, including those just metamorphosed, are three dorsal stripes of varying widths and intensities, sometimes continuous from the head to just above the anus and sometimes broken up into a series of beadlike spots. Between these three main stripes are usually finer stripes or series of elongate dots, darker and more prominent in the posterior region. There is also a wide, dark, lateral stripe going from the nostril to the groin, and below it a shorter, narrower stripe from the corner of the mouth to behind the axilla. These two stripes seem to be constant throughout life. The dorsal pattern, however, becomes simpler as the frog grows, for the finer stripes or dots between the three main dorsal stripes disappear almost entirely as maximum size is approached, and the remnant of the former intermediate stripes appears as a few widely scattered elongate spots. In every frog over 40 mm. in total length, the body pattern clearly consists of three dorsal and two lateral stripes (on each side), with very little trace of the original fine lines formerly lying between the dorsal stripes. The form described by A. Lutz as *H. semiguttata* has this coloration of the old adult, and the type which I examined measures 43 mm. in length, near the known maximum. USNM 102285 is very much like the type of *semiguttata* and is also 43 mm. in length. USNM 81125 and 96581-4 are large in size (42 to 44 mm.) and show the old adult pattern well. *H. striata*, on the other hand, is based upon a partly grown individual having the additional dots and lines still showing. USNM 98025, a young frog 27 mm. long, is not lined at all; its pattern is composed of 3 series of large beads separated by series of small dots. The simple, lined pattern found in frogs above 40 mm. may be the result of sex as well as of age, since all the large specimens are females.

Remarks.—The voice of the male of this common species is a characteristic chirping *pst-pst-pst* often repeated. The vocal sac is median, and in captivity the adults in the glass containers may be seen singing at night and sleeping all day. At Nova Friburgo they were collected as late as May 12 in the shallow water of a garden pool where they were still coming at night to breed. By day, they were taken from the midst of thorny tangled bushes overhanging the pool, where a number of metamorphic young were also found. The females are very prolific, and enormous quantities of gelatinous egg masses are found in the mountain pools fed by running water in the Serra da Bocaina, in Nova Friburgo, and in Colonia Alpina near Teresópolis (this last being recorded by Goeldi). The tadpoles develop with comparative rapidity in two months in the laboratory, and probably even more rapidly in natural surroundings. They are plump, mottled, and dark, and are found in running and slightly moving water. Some young frogs not quite metamorphosed, USNM 96707, measure between 16 and 17 mm. in head and body length, the limbs being completely developed and the tail a mere stub. The pigment on the dorsal surface is confined to scattered black dots, although the dark lateral stripe is evident on the loreal region and sides of the body, while the outer surfaces of the limbs show dark and light stripes.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, ZSBS 112/27, A. Lutz, 1926.

Minas Gerais: Agua Limpa, Ouro Prêto, USNM 98024–7, Cochran, Dias, and Venancio, Mar. 19, 1935. Bello Horizonte, Country Club, USNM 97860, Lisboa, Cochran, and Venancio, Mar. 13, 1935. Lagôa Santa, UZMK 54–55, Warming; UZMK 52–53.

Rio de Janeiro: Alto Itatiaia, Serra do Itatiaia, AMNH 17057, Holt. Bonito, Serra da Bocaina, USNM 96706–7, A. Lutz, Dec. 15–31, 1931. Colonia Alpina, near Teresópolis, BM 93.9.30.4, Goeldi. Nova Friburgo, ZMB 7465 (2; cotypes of *Hyla striata*). Serra da Bocaina, USNM 81125–7, 96581–94, A. Lutz, 1930; ZSBS 39/47, (5), A. Lutz, 1932. Teresópolis, BM 93.12.22.12–15, Goeldi. Valvera, near Nova Friburgo, USNM 97748–59, 101136, A. Lutz, B. Lutz, Cochran, May 9–13, 1935.

Santa Catarina: São Bento, IOC (type of *H. semiguttata*), Behr, 1915.

São Paulo: Alto da Serra, USNM 97789, Cochran and Venancio, Apr. 26, 1935; USNM 102284–5, Spitz, 1927; MRHN IG 9308 Reg. 40 (3), Massart, Oct. 7, 1922. Campos do Jordão, MP 85. Ferraz de Vasconcelos, DZSP 1861, 1872–4, 1876, 1878, 1880, 1882, 1884–5, 1890–4, 1896, Bokermann, January 1948. São Paulo, USNM 96854–6, Apr. 5, 1933.

Hyla raddiana raddiana Fitzinger

Figure 11

1823. *Hyla lateralis* (not of Daudin) Raddi, p. 67.

1826. *Hyla raddiana* Fitzinger, p. 63 (type locality, "ex America, Brasilia").—Berg, 1896, pp. 151, 201.—Andersson, 1906, p. 14.—Nágera, 1915, p. 24.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 296.—Marelli, 1924, p. 587; 1931, p. 201.—Mertens, 1926b, p. 4; 1928, p. 298; 1950, p. 174.—Miranda-Ribeiro, 1926, p. 85.—Estable, 1942, p. 51.

1841. *Hyla pulchella* Duméril and Bibron, p. 588 (type locality, Montevideo).—Steindachner, 1864a, p. 241, pl. 9, figs. 2–2,c.—Weyenbergh, 1876, p. 165.—Boulenger, 1882a, p. 375; 1885a, p. 196; 1886b, p. 444; 1888c, p. 416.—Cope, 1885a, p. 185.—Boettger, 1892, p. 41.—Peracca, 1895, p. 29; 1897, p. 18.—Schupp, 1900, p. 320.—Baumann, 1912, p. 163.

1841. *Hyla leucomelas* Duméril and Bibron, p. 576 (type locality, Montevideo).—F. Müller, 1882, p. 140.

1930. *Hyla radiana* Bonjour, p. 394.

1942. *Hyla leucomela* Estable, p. 52.

Description.—Adult male, BM 85.9.7.23, Rio Grande do Sul. Vomerine teeth in two short, heavy, transverse, narrowly separated patches behind the posterior border of the choanae; tongue two-thirds the width of mouth-opening, cordiform, slightly indented on its free posterior border; snout short, rather truncate when seen from above and in profile, the upper jaw projecting somewhat beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about one-third that from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded but distinct, loreal region slightly concave; eye large, its diameter less than its distance from end of snout; interorbital diameter somewhat greater than width of upper eyelid, greater than distance between nostrils. Tympanum very distinct, equal to one-half the diameter of eye, separated from eye by an interval equal to two-thirds its own diameter. Fingers webbed only at their base, fourth much longer than second, reaching to base of disk of third which covers two-thirds the tympanic area; only a slight tubercular rudiment of a pollex; toes one-half webbed, fifth longer than third, disk of fourth covering two-thirds the tympanic area; a small inner, but no outer metatarsal tubercle; a heavy inner tarsal ridge; a similar ridge across the heel; no dermal appendage on heel. Body rather elongate, in postaxillary region slightly narrower than greatest width of head; when hind leg is adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow just touch; when hind legs are bent at right angles to the body, heels overlap slightly. Skin of upper parts quite smooth; a slight glandular ridge beginning on canthus rostralis, becoming heavier as it encircles upper border of tympanum, and running diagonally backward and downward behind tympanum to end above the shoulder; a wavy transverse glandular line in front of anus; a faint, glandular line along outside of forearm, another scarcely indicated on tibia; skin of throat and chin slightly granular, that of belly and lower femur very heavily granular; no apparent skinfold across the chest. A pair of external vocal sacs appearing as)(-shaped skinfolds at the sides of the throat.

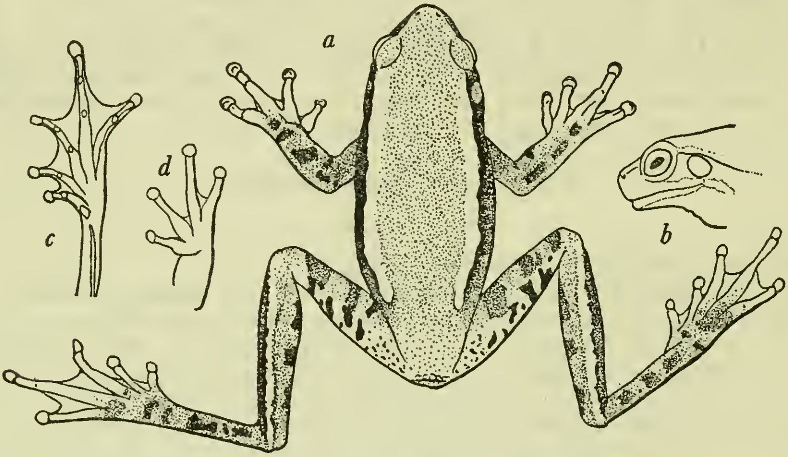


Figure 11.—*Hyla raddiana raddiana*, USNM 12493: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × 1.

Dimensions.—Head and body 48 mm.; head length 14 mm.; diameter of eye 4 mm.; width of head 13.5 mm.; femur 23 mm.; tibia 24 mm.; hind limb 75 mm.; fore limb 24 mm. From DZSP 2528, a male of identical head and body length: Foot 22 mm.; hand 15.5 mm.

Color in alcohol.—Dorsal ground color smoke gray anteriorly, becoming drab-gray on posterior back and upper limb surfaces; a cream-color dorsolateral line beginning behind the eyes, widening on the sides and becoming indistinct in front of the groin, a slate-gray line edging its lower border for most of its extent; another cream-color stripe beginning below the eye, and covering the lower lip and extending onto the axilla, where it merges with the ventral coloration; sides below cream color; dorsolateral stripe smoke gray, with numerous round, black dots in the groin, on anterior femur, on sides halfway to shoulder, and in axilla; coarser black blotches on posterior femur; a few dark spots on inner parts of tibia and foot and some small black dots below the white glandular ridge at anterior anal border. Outer surface of tibia with a wide white line, forearm with a very indistinct one. Ventral surfaces pale olive-buff, immaculate.

Variations.—The largest example, USNM 96798, a female from Alto da Serra, measures 56 mm. in head and body length. This one and two others from the same locality resemble BM 85.9.7.23 very closely in details of structure and in coloration, except that the anterior surface of the femur is less heavily spotted with black in the former specimens, while the concealed inner surface of the tibia is also less darkly pigmented. In the smallest of the Alto da Serra frogs, as well as in USNM 97212, from São Francisco de Paula, the snout is more pointed at the tip than is that of the described specimen. This character is of notable variability in many other species.

Remarks.—The name *Hyla pulchella* for the Argentine and Uruguay frogs is apparently correctly synonymized with *H. raddiana* by Nieden. None of the specimens in the U. S. National Museum previously identified as *pulchella* can be distinguished in any way from the typical *raddiana* specimens.

Much more distinct, however, is *H. raddiana andina* Mertens, because of its apparently larger head and its quite different color pattern. Since this form is not known to occur in Brazil, a discussion of it is not included here. The males of *andina* have the)(-shaped skinfolds at the sides of the throat very well developed, and as few other frogs except *raddiana* show this characteristic, it is evident that the forms are allied.

Specimens examined

BRAZIL:

Rio de Janeiro: MHNP 6244, Jobert, 1879.

Rio Grande do Sul: BM 85.9.7.23, von Ihering. Canella, ZSBS (3), Gliesch, 1929. Estrella, ZSBS 27, Gliesch, May 1926. Santa Maria, IB 611, 616; USNM 121346–7, Instituto Butantan. São Francisco de Paula, USNM 97212, Pinto, Jan. 29, 1931.

Santa Catarina: Humboldt, ZSBS (1), Erhardt, 1914. Lagôa, IB 571–2. Ouro Verde, ZSBS (16), Lõffler, Nov. 15, 1927.

São Paulo: Alto da Serra, USNM 96798–800, A. Lutz. Butantan, IB 60. Capital, IB 587. Ferraz de Vasconcelos, MHNP 50-253 (2), Bokermann, January 1950. São Paulo, DZSP 2504–33, Bokermann. Terceira Repressa, ZSBS (1), Schindler, Dec. 26–31, 1937.

ARGENTINA: USNM 73522, Breyer brothers; USNM 97187, A. Lutz. Concepción del Uruguay, USNM 14847, Barrows, 1880–81. Estancia Laguna del Oro, near Pueblo Ness, Hamonn, April 1927. Lavalle, Buenos Aires, USNM 63505, Wetmore, Nov. 3, 1920.

URUGUAY: Carrasco, USNM 64418, Wetmore, Jan. 16, 1921; USNM 65557, Felippone. Malvin, USNM 65593, 68039, Felippone. Montevideo, USNM 97186, A. Lutz; USNM 14692, Safford, May 4, 1887; USNM 65588–90, Felippone.

SOUTH AMERICA: USNM 12493.

Hyla raniceps **(Cope)**

Plate 8, Figures a–c

1862. *Hypsiboas raniceps* Cope, 1862b, p. 353 (type locality, Rio Vermejo, Paraquay).

1889. *Hyla spegazzinii* Boulenger, p. 247, pl. 2, figs. 1, 1a, (type locality, Colonia Resistencia, S. Chaco, Argentine); 1894, p. 348; 1898b, p. 126.—Peracca, 1895, p. 29; 1904a, p. 13.—Berg, 1896, pp. 151, 208.—Budgett, 1899, pp. 305, 327.—Méhely, 1904, p. 225.—Nieden, 1923, p. 280.—L. Müller, 1927, p. 265.—Müller and Hellmich, 1936, p. 73, fig. 26.—Mertens, 1928, p. 297, fig. 1.

1928. *Hyla spegazzini* Parker, p. 98.—Miranda-Ribeiro, 1937a, p. 55.—Schubart, 1939, p. 52.

1937. *Hyla megapodia* Miranda-Ribeiro, 1926 (no description), pl. 5, fig. 5; 1937d, p. 67 (first description).—Carvalho, 1939a, p. 280.

Description.—Adult male, BM 1928·1·12·30, Urucum, near Corumbá, Mato Grosso. Vomerine teeth in two short, heavy, /‾\-shaped, well-separated series between and behind the posterior borders of the choanae; a row of well-developed maxillary teeth; tongue about three-fifths the width of mouth-opening, an elongate oval in shape, with a slight indentation on its posterior border which is moderately free; snout rather elongate, pointed when viewed from above, rounded in profile, the upper jaw projecting considerably beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about two-thirds that to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded but well defined, loreal region slightly concave, nearly vertical, the upper lip scarcely projecting below it. Eye moderately large, its diameter equal to its distance from the nostril; interorbital diameter equal to that of the very wide upper eyelid, very slightly greater than distance between nostrils. Tympanum large, distinct, about three-fourths the diameter of the eye, separated from eye by an interval equal to about one-third its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching to base of disk of third, which covers nearly one-half the tympanic area; a pronounced rudiment of a pollex on first finger; a faint low glandular ridge along outer side of forearm; toes three-fourths webbed, third and fifth subequal, disk of fourth only slightly smaller than largest finger disk and covering about one-third the tympanic area; a distinct oval inner but no outer metatarsal tubercle; a narrow low ridge along inside of tarsus, and a wider one on outside of tarsus extending onto the heel but not forming a dermal appendage or tubercle; body quite elongate and moderately slender, in postaxillary region slightly less than greatest width of head; when hind leg is adpressed, heel reaches considerably beyond tip of snout; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to the body, heels considerably overlap. Skin of upper parts very minutely glandular, more coarsely glandular between the eyes; irregular glandular lines running down the back, with a coarser dorsolateral gland on each side of the back and a heavy lateral one extending behind the ear halfway down the sides as a continuation of the heavy supratympanic ridge; skin of chin minutely granular, of chest almost smooth, of belly and lower thighs heavily granular; a heavy skinfold across the chest, and another one anterior to it where the large median external vocal pouch ends.

Dimensions.—Head and body 69 mm.; head length 22 mm., width 22 mm.; femur 36 mm.; tibia 40 mm.; foot 29 mm.; hand 19 mm.

Color in alcohol.—Dorsal ground color dark drab-gray, with irregular coarse marblings of slate color beginning between the eyes and continuing to end of body; loreal region slate gray, fading slightly towards the upper lip, which has a narrow black border, breaking up beneath the eye to large dark spots; tympanum and surrounding area slate color, with an irregular stripe of the same color continuing along the glandular lateral fold from the tympanum; femur with 7 to 9 heavy, wide, slate bands extending down in front and behind to the granular lower surface, regular and parallel on top and in front, but breaking up into coarse dark spots or λ-shaped marks behind; forearms irregularly crossbanded with slate; sides of body with heavy vertical slate markings especially prominent towards the groin; top of foot and tarsus with slate-colored bars; a wide olive-buff line along outside of tarsus and forearm following the low glandular ridges; ventral surface olive-buff to pea green, the lower labial borders immaculate, then a heavy spotting of slate on chin, lightening to a dull slate suffusion on sides of throat; anterior part of chest nearly immaculate; a few scattered dark dots in front of shoulders and just behind the skinfold across the chest; remainder of ventral surfaces immaculate except for some small dark postanal dots.

Variations.—The degree of development of the pollex is extremely variable: In MCZ 12125, from Marajó Island, it can scarcely be noticed; in MCZ 12124, from the same place, it is a distinct knoblike protuberance, while in MCZ 374, from Rio Puty, it has a small sharp spine in addition to the knob. The vomerine teeth, prominent in all examples, are quite slanting in some but nearly transverse in others. Other structural characters appear to be quite uniform; the broad upper eyelid, the graceful, elongate contour of the head, the long legs, the degree of webbing, all vary less than is usually the case in a species of Brazilian hylid. The color pattern on the front and rear femur is also very characteristic, and even in faded specimens the dark vertical bars are evident and cover much more of the leg surface than is usual in species having crossbarred legs. In this respect one might confuse *H. raniceps* with *H. crepitans*, as *crepitans* also has the femur nearly encircled by dark bars, but its head shape is very different, and there are other characters so dissimilar that a careful examination dispels the apparent likeness.

Color in life.—A sketch by Pugas of a specimen 29 mm. in length, from Natal, collected August 7, 1928, shows the following colors: Dorsum pale paris green to emerald green, except knees and anal region, which are white; a white line along outer border of forearm and tarsus; a similar white line beginning behind eye and passing above tympanum; a sepia line along canthus rostralis; a round russet spot on upper eyelid; a median russet stripe beginning between the eyes and narrowing and fading out before the sacrum is reached, its lateral borders very irregular (this is probably not a dermal coloring, but shows through the flesh, for the preserved specimens now show a light-colored tissue below the skin in this region). Iris apparently slate-gray.

Remarks.—Ten specimens of tadpoles and very young frogs, USNM 97028–38 from Natal, Rio Grande do Norte, are apparently referable to this species. The young frogs were taken on leaves of low bushes. A tadpole with fully developed limbs has a head and body length of 19 mm. and a tail length of 23 mm. The smallest fully metamorphosed one measures 18 mm.; at this stage the vomerine teeth are just beginning to differentiate from the soft bone of the head, the maxillary teeth are not yet perceptible, and the still squarish and truncate outline of the jaw is suggestive of the tadpole mouth. When the young frog has grown to a length of 24 mm., the maxillary teeth are already perceptible and the vomerine teeth are in characteristic dense large patches. The lower jaw at this stage is still somewhat truncate, and it is only at a length of 28 mm., according to the specimens at hand, that the pointed outline of both upper and lower jaw is fully assumed.

Three cotypes of *Hypsiboas raniceps*, USNM 5408 and 12172, are in poor condition. One of the latter, however, has the color pattern on the femur and sides still quite distinct. Five other cotypes, USNM 5403 and 12160, are in very good condition, and leave no room for doubt that it was really an example of the same species which served as a basis for Boulenger's figure and description of his *Hyla spegazzinii.*

The male of *raniceps*, instead of having simply a knoblike spur usually ending in a large or small thumb spine on the first finger, is often equipped with a heavy semicircular excrescence or pad in place of the knob and spur. Some individuals, such as USNM 98818 from Bahia, have a small knob as well as the semicircular pad. All examples of *raniceps* have a very heavy fold across the chest between the axillae. A paratype of *H. megapodia*, USNM 102687, sent to the U. S. National Museum by Dr. Miranda-Ribeiro, is very decidedly *raniceps* in all such characters as extreme length of leg, webbing of toes and fingers, presence of a chest fold, granulations on belly, position of vomerine teeth, coloration of posterior femur, and presence of a sharp-edged, disklike thumb pad. The bodily measurements of this paratype of *megapodia* fall well within the variational limits of those of *raniceps.*

Specimens examined

BRAZIL: MCZ 374, Rio Puty.
  Bahia: Bom Jardin, USNM 98818, Dias, Apr. 13, 1935.
  Ceará: Fortaleza, USNM 109159–62, von Ihering, 1936.
  Mato Grosso: Urucum, near Corumbá, BM 1928,1.12.30, Collenette.
  Minas Gerais: Januária, MCZ 1532 (3).
  Pará: Ilha Marajó, MCZ 12124–5.
  Pernambuco: USNM 57759, Hurter, December 1895.
  Rio Grande do Norte: Natal, USNM 81124, 97029–38, 97047, 1928.
PARAGUAY: USNM 5408, 12172 (2; cotypes of *Hypsiboas raniceps*), Page.
  Río Vermejo, USNM 5403 (4), 12160 (cotypes of *Hypsiboas raniceps*), Page.

4. *minuta*—group

The minuta group—*b. bipunctata, decipiens, elongata, g. goughi, g. baileyi, leucophyllata, minuta, nana* and *werneri*—together with the *rubra* group are quite perplexing, since the extent of individual variation in some of the species of each is truly astonishing. In Group 4, for instance, the only species which maintains a fair degree of uniformity throughout its range in southeastern Brazil is *bipunctata bipunctata.* The others present a surprising diversity of overlapping structural features or color phases, many of which were formerly accorded specific rank, *minuta* alone having been known under no less than four additional names.

All the members of this group are smooth-skinned, and all are small in size, between 20 and 27.5 mm. for maximum length, excepting *leucophyllata*, which is known to reach a length of 35 mm. The immaculate (yellow or red in life) anterior and posterior femur is a noteworthy character, which, taken with their small size, separates them from any of the first three groups, as well as from most species of the *rubra* group.

The easiest member of this group to recognize is *bipunctata bipunctata*, since it has a peculiar areolate network of purplish brown lines encircling yellow or white spots on the upper lip and side of anterior body, a pattern not repeated exactly in any other Brazilian hylid. A subspecies, *bipunctata branneri* Cochran, from Pernambuco, is characterized by the absence of the areolation and the presence of a single silvery spot below the eye, among other features.

H. leucophyllata has an equally characteristic pattern, that of a large, brown rectangle covering the back and extending onto the eyelids, completely bordered with a wide gold or silver border that fades to white in alcohol. In rare instances this pattern is obscured by dark suffusions over the light margins.

The known distribution of these small frogs is often discontinuous. Such small quarry is often passed over by collectors in favor of larger and more conspicuous creatures. It is likely that systematic collecting may do much to bridge the apparent gaps in the distribution and widen our appreciation of the number of color and pattern combinations possible in these rather unstable forms.

For a statistical analysis of measurements of members of the *minuta* group here discussed, see pages 373 and 377.

Key to frogs of Group 4 in southeastern Brazil

a^1. Fingers webbed only at the base; diameter of eye equal to its distance from end of snout; a dark dorsolateral line from canthus to groin.
  b^1. Toes ¾ webbed; adpressed heel reaching to center or anterior border of eye; snout relatively short and rounded at the tip . . **elongata** (p. 107)
  b^2. Toes ½ webbed; adpressed heel reaching to tympanum; snout relatively narrow, elongate and pointed at the tip . . . . **nana** (p. 124)
a^2. Fingers ⅓ webbed; toes ¾ webbed.
  b^1. Adpressed heel reaching anterior border of eye.
    c^1. Diameter of eye slightly less than its distance from end of snout; interorbital diameter twice the width of upper eyelid; upper jaw projecting considerably beyond lower; size up to 20 mm. . . . **decipiens** (p. 104)
    c^2. Diameter of eye greater than its distance from end of snout; interorbital diameter not exceeding 1⅓ times the upper eyelid.
      d^1. Vomerine teeth arising in front of the choanae, converging posteriorly; no round white spot on upper lip; size to 19 mm. **goughi goughi** (p. 109)
      d^2. Vomerine teeth arising between the choanae.
        e^1. Vomerine teeth well separated.

f^1. Vomerine teeth weakly developed; upper jaw projecting slightly beyond lower; size up to 35 mm. . . . **leucophyllata** (p. 115)

f^2. Vomerine teeth distinct; upper jaw projecting considerably beyond lower; a round white spot on upper lip; size up to 21 mm. . . . . **goughi baileyi** (p. 113)

e^2. Vomerine teeth narrowly separated; upper jaw projecting somewhat beyond the lower; size to 19 mm. . . . . . . **werneri** (p. 127)

b^2. Adpressed heel reaching to nostril or beyond.

c^1. Heel reaching to nostril; diameter of eye equal to its distance from end of snout; size up to 26.5 mm. . . . . **minuta** (p. 119)

c^2. Heel reaching to end of snout; diameter of eye greater than its distance from end of snout; size up to 25.5 mm.
bipunctata bipunctata (p. 121)

Hyla bipunctata bipunctata Spix

Plate 8, Figures d–f

1824. *Hyla bipunctata* Spix, p. 36, pl. 9, fig. 3 (type locality, Bahia).—Peters, 1873a, p. 213.—Boulenger, 1882a, p. 216.—Werner, 1897a, p. 216.—Baumann, 1912, p. 163.—Nieden, 1923, p. 287.—Miranda-Ribeiro, 1926, p. 89, pl. 10, fig. 4.—Mello-Leitão, 1937, p. 303—Myers, 1946, pp. 13, 31.—Mertens, 1950, p. 175.
1830. *Scinax bipunctata* Wagler, p. 201.
1834. *Hyla capistrata* Reuss, p. 58, pl. 3, fig. 4 (type locality, Brazil).—Günther, 1858, p. 106.
1841. *Hyla pumila* Duméril and Bibron, p. 565 (type locality, Brazil).
1950. *Hyla b[ipunctata] bipunctata* Mertens, p. 182, fig. 4.

Description.—Adult male, USNM 97275, Manguinhos, Districto Federal. Vomerine teeth in two short, well-separated, transverse groups between the choanae; tongue half as wide as mouth-opening, cordiform, distinctly notched and free behind; snout very short and rounded when viewed from above, truncate in profile, the upper jaw extending only slightly beyond the lower; nostrils superolateral, projecting, their distance from end of snout about half that to anterior border of eye, separated from each other by an interval about equal to their distance from eye. Canthus rostralis very poorly defined, joining the loreal region, which is flat. Eye large, prominent, its diameter slightly greater than its distance from end of snout; interorbital diameter about 1⅓ times the width of upper eyelid, greater than distance between nostrils. Tympanum distinct except at its upper border, where it is somewhat obscured by the slightly granular skin of the upper parts, about one-half the diameter of the eye, separated from the eye by an interval nearly equal to its own diameter. Fingers one-third webbed, fourth a little longer than second; disk of third finger practically covers the tympanum; no rudiment of a pollex visible; toes three-fourths webbed, third and fifth subequal; disk of fourth toe covering about two-thirds the tympanum; a distinct projecting inner metatarsal tubercle but no outer one; a faint ridge on inner side of tarsus near heel; no dermal appendage on heel; body not elongate, in the postaxillary region about equal to the greatest diameter of head; when hind leg is adpressed, heel reaches end of snout; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts very finely granular or pustular; no very pronounced glandular ridge encircling upper part of tympanum; skin of throat and chest entirely smooth, that of belly finely granular, that of posterior femur and anal region very coarsely granular; a more or less apparent skin fold across the chest. A prominent external median vocal sac.

Dimensions.—Head and body 24.5 mm.; head length 8 mm., width 8.5 mm.; femur 12 mm.; tibia 12.5 mm.; foot 10 mm.; hand 7 mm.

Color in alcohol.—Upper parts of head and back fawn color, of femur and concealed surfaces of tarsus pale straw color, of remainder of upper surfaces of limbs pinkish vinaceous. A seal-brown triangular mark in the middle of the back, and some smaller irregular brown markings anterior and posterior to it. Side of head with a very characteristic alveolar pattern of Indian purple surrounding pale straw-colored spots; this pattern becoming paler below the brown line which leads from posterior eye over tympanum and half way to groin. No markings whatever on the femur. Tibia with four narrow brown crossbands, knee with a similarly colored cap, and heel and outer border of tarsus and metatarsus with a regular brown stripe. A few narrow crossbands on forearm. Anus bordered above by a crescentic brown mark. Ventral surfaces pale chrome yellow fading to pale cream color on tibia and foot.

Color in life.—From sketch by author, made from one in the series containing the specimen just described. Dorsal ground color buff, with irregular dark-edged heliotrope purple spots; side of head and body light buff with an areolated pattern of curved maroon lines leaving the buff ground color showing through in regular circles of different sizes; lower part of sides and belly, also forearm and chest citron yellow; gular region orpiment orange; femoral surface bright orange chrome; a dark anal patch. The iris is chrome yellow next to the pupil, becoming spotted with crimson, and finally solid maroon at the periphery. The black pupil is transversely elliptic.

In two sketches by Sandig of specimens presumably from near the city of Rio de Janeiro the dorsal body color is ecru-drab in one individual, orange-rufous in another, both having dark-outlined olive spots on the back. The hand is sulphur yellow above and below. The upper and lower surfaces of the foot are suffused with orange, the webs being paler and the disks darker orange. The tibia, foot, and forearm are crossbanded with sepia, the heel and outside of the tarsus are seal brown, and the knee has a dark patch. The throat, chin, belly, and anal region are wax yellow.

Variations.—The maximum size is not great, USNM 96354 measuring 26 mm. in head and body length, while several other individuals equal but do not exceed it. The heel appears to extend a trifle beyond the end of the snout in USNM 97561, while in some of the other examples it scarcely reaches beyond the anterior corner of the eye. The color pattern within certain definite limits is subject to great variation—the dorsal pattern of dark triangles and chevrons may be greatly increased and elaborated, or it may be completely lacking. The alveolar pattern on the upper lip and side of head is invariably present when the specimens are not too badly bleached, while the dark caps on knee and heel and the dark stripe along the outer borders of the foot are present on all but a few of the palest examples.

A relatively slight degree of variation exists in the critical proportions of the 54 specimens measured. A variation of only 10 percent in the femur and tibia proportions is unusual.

In analyzing the color pattern, it was found that 6 females and 3 males (out of 13 females and 38 males) lacked a dorsal pattern. In 6 males it was faint or small, while in the remainder of the specimens of both sexes the dorsal pattern was very apparent, consisting of a crossbar or W-shaped or V-shaped mark between the eyes, followed by a large triangular or irregular dark mark behind the shoulders, its lower edges often prolonged to encircle a light area on the sacrum. The areolated pattern on the upper lip is always present, being usually visible even in bleached examples, and it constitutes the best single character for recognizing this very distinct species. The femur is immaculate, usually colorless in alcohol, but vivid orange or yellow in life.

Remarks.—This species is very common at Manguinhos, near the city of Rio de Janeiro. The call is a high, frequently repeated *tit-tit-tit-tit.* When many sing together, the chorus is very loud and can be heard at a distance of one kilometer.

The adults are found by day in palms and other lofty trees in open fields but at night they come down to pools of still water. Eggs laid in the laboratory of the Instituto Oswaldo Cruz required a month to metamorphose. In nature, the eggs and tadpoles occur in stagnant, quiet water.

Most of the small species of *Hyla*, and especially this one, have transparent skins, so transparent on the legs that the red color of flesh is visible.

Specimens examined

BRAZIL:

Bahia: ZSBS 2497/0 (4; includes type of *H. bipunctata*), Spix.

Districto Federal: Bom Successo, USNM 96162–81, A. Lutz, 1923–24. Manguinhos, USNM 96130–6, A. Lutz; USNM 97272–90, Venancio, Feb. 11, 1935. Rio de Janeiro, USNM 81112–5, 96354–9, A. Lutz; USNM 123569–72, B. Lutz; ZSBS 30/1947 (4), ZSBS (1), A. Lutz, 1932. Rua São Januário, USNM 102442–3, Carvalho. Swamp 40 km. southwest of Rio de Janeiro, USNM 97561, A. Lutz, Cochran, and Venancio, Feb. 20, 1935.

Espírito Santo: USNM 102280.

Rio de Janeiro: Angra dos Reis, USNM 96379–80, A. Lutz, September 1925. Entre Rios, AMNH 513, A. Lutz, 1922.

Hyla decipiens A. Lutz

Plate 8, Figures f–i

1925. *Hyla decipiens* A. Lutz, 1925b, p. 212 (type locality, swamps near Rio de Janeiro); 1926a, pp. 6, 13.—Myers, 1946, pp. 12, 29.—B. Lutz, 1947, p. 243.

Description.—Adult female, USNM 96194 (cotype), Bom Successo, city of Rio de Janeiro. Vomerine teeth absent (in this specimen); tongue two-thirds as wide as mouth-opening, almost round, free and unnotched behind; snout moderately short and rounded when viewed from above, truncate and declivous in profile, the upper jaw projecting considerably beyond the lower; nostrils superolateral, somewhat projecting, their distance from end of snout about two-thirds that to anterior border of eye, separated from each other by an interval about equal to their distance from eye. Canthus rostralis rounded, not well defined; loreal region slightly concave. Eye large, prominent, its diameter slightly less than its distance from end of snout; interorbital diameter about twice the width of the upper eyelid, which is very narrow, greater than distance between nostrils. Tympanum distinct, about one-half the diameter of the eye, separated from the eye by a distance equal to its own diameter. Fingers one-third webbed, fourth considerably larger than second, reaching disk of third which covers the tympanic area; a semicircular protuberance at base of fourth finger especially prominent in the male; toes three-fourths webbed, fifth slightly longer than third, disk of fourth toe covering the tympanic area; a distinct projecting tubercle at base of first toe, but no apparent metatarsal tubercles; no apparent tarsal ridge; no dermal appendage on heel; body not elongate, in the postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow just fail to meet; when hind legs are bent at right angles to body, heels slightly overlap. Skin of upper parts quite smooth; a pronounced glandular ridge following the upper border of the tympanum and ending above the shoulder; skin of throat and chest entirely smooth, that of belly coarsely granular, that of posterior femur and anal region nearly smooth or slightly glandular. A slight skinfold across the chest. (A pair of rather small lateral external vocal sacs in the male.)

Dimensions.—Head and body 19 mm.; head length 7 mm., width 7 mm.; femur 9 mm.; tibia 10 mm.; foot 7.5 mm.; hand 5 mm.

Color in alcohol.—The cotype described is badly faded to a uniform pale drab, with no markings visible except a pale brown stripe beginning on the snout, continuing along the loreal region and across the tympanum, and fading out on the sides halfway to the groin. Traces of a wide pale stripe dorsal to this are faintly apparent, and a light triangular area covering the snout anterior to the eyes. Very faint traces of dark narrow crossbars are to be seen on the tibia. The ventral surface appears immaculate. The eggs retained within the body give the abdomen a dark hue.

Color in life.—The following color notes were taken on seven specimens kept alive from the collection made at Recreio dos Bandeirantes: Back ochraceous-rufous, ochraceous, or clay color to golden metallic citron yellow. The dark-backed ones have a ⌂-shaped golden-yellow stripe from snout and along dorsolateral line. A few were almost chestnut behind the light triangle on snout. The chestnut color was found also on the sides. Throat and lower part of sides, disks of toes, lower tibia, and femur pale sulphur to primrose yellow. Anterior part of belly opaque white. Posterior part of belly translucent vinaceous-buff to darker. Anal region and outer margins of limbs (in sitting position) with large metallic gold spots. Iris metallic-vinaceous next to pupil, darker vinaceous-rufous mixed with coppery and gray spots toward periphery.

Variations.—In this species the variation in the vomerine teeth is most interesting. Of all frog characters, the presence or absence of vomerine teeth has been considered one of the most stable, but here we have fluctuations from complete toothlessness to the possession of two very distinct patches. In neither the cotype USNM 96194, from Bom Successo, nor USNM 96150, from Manguinhos, can any vomerine teeth be made out, although the bone which usually holds them is barely perceptible. This ridge without definite teeth is quite apparent in the mouth of USNM 97642 from Sacco São Francisco. Three topotypes, USNM 96151–3, from near the Instituto Oswaldo Cruz, at Mangunhos, have rather weakly developed patches of small teeth. But the series of 9 frogs, USNM 97578–86, from Recreio dos Bandeirantes, is truly remarkable. In these specimens, all taken on neighboring clumps of bulrushes not 50 feet apart in a swamp, six individuals have very strongly apparent sets of posteriorly converging, well separated teeth between the choanae, two examples (97579 and 97582) have a set of teeth on one side of the mouth and none on the other, while one (97581) is entirely toothless.

In other structural characters there is not much variation. The webbing of hands and feet is quite constant, and the proportions of the limbs do not vary much. The tongue is slightly concave at its posterior margin in some of the specimens. The color pattern varies greatly in intensity, and in a very few examples the back is immaculate, with only the dark lateral stripe persisting. In some of the frogs, the brilliant golden ∩-shaped mark surrounding the deep chestnut middorsal area suggests somewhat the color pattern of *H. leucophyllata.* Many have small dark spots over the back, particularly noticeable on the anterior half.

Remarks.—This frog might be taken for the young of *Hyla leucophyllata,* were it not for its shorter head and foot. In alcohol, the dorsal patterns of *H. decipiens* and Brazilian examples of *leucophyllata* appear similar at first glance, consisting of a light head and light dorsolateral lines, with rectangular middorsal brown area between the light borders. In life, the light areas on the back of *decipiens* are less metallic appearing. Upon close examination, other differences in pattern are apparent. The white areas of *leucophyllata* are much more distinct posteriorly than they are in *decipiens*, since the dorsolateral white stripes scarcely reach to the groin in *decipiens*, while the apparent stripes in *leucophyllata* are really the dorsal color showing beside the dorsal rectangular brown mark, hence the entire sacrum is white posteriorly behind the brown mark, this white area tapering to a point just above the anus.

On February 14, 1935, a collecting trip to Sacco São Francisco was made by Dr. Adolpho Lutz, Joaquim Venancio, and myself. In a boggy spot where an inch or two of standing water was sometimes found, and where small shrubs and vines of several kinds were plentiful, some egg-masses had been deposited on leaves hanging over the water. It is well known that *Phyllomedusa* deposits its eggs in such a manner on leaves overhanging the water, but this locality is not one at which *Phyllomedusa* is known to occur, and since a full-grown *Hyla decipiens* was taken at the spot, the conclusion was that these were *Hyla* eggs, uniquely placed over the water instead of in it. Collections of 30 or 40 different egg-masses were made in a few minutes, and the next day some of these were photographed in the laboratory. The remainder of the leaves and their adhering egg-clusters were put on the sides of glass funnels where the already hatching tadpoles slid down into the water in the aquaria beneath them. From this point, watercolor sketches were made at each developmental stage. The beautiful and remarkable coloring of these tadpoles was not long in appearing.

Although I could not trace the development of the later stages in the laboratory at Manguinhos, Dr. Bertha Lutz under the date of October 9, 1935, writes that "The tadpoles . . . metamorphosed as *Hyla decipiens* after over 6 months."

Specimens examined

BRAZIL:

Districto Federal: Bom Successo, USNM 96194 (cotype of *H. decipiens*), A. Lutz, Apr. 3, 1925. Manguinhos, USNM 96150–3, 1931; USNM 97291, Venancio, Jan. 23, 1935. Recreio dos Bandeirantes, USNM 97578–86, B. Lutz, Cochran, and Venancio, Feb. 9, 1935; USNM 97605–9, Campos, Feb. 11–16, 1935: MZUM 104120 (3), 104141, Bailey, 1941.

Rio de Janeiro: Sacco São Francisco, near Niterói, USNM 97642–3, A. Lutz, Cochran, and Venancio, Feb. 14, 1935.

***Hyla elongata* A. Lutz**

Plate 8, Figures j, k

1925. *Hyla elongata* A. Lutz, 1925a, p. 139 (type locality, São Paulo and Bello Horizonte [by inference]); 1926a, pp. 6, 13.—Myers, 1946, pp. 12, 29.

Description.—Adult female, USNM 96861 (cotype), Aviation Field near city of São Paulo. Vomerine teeth in two short but heavy, posteriorly converging, narrowly separated patches between and extending slightly behind the posterior level of the choanae; tongue three-fourths as wide as mouth opening, rounded and a little broader than long, its posterior border almost entirely attached and with scarcely any indication of a notch; snout short, rounded when viewed from above, truncate in profile, the upper jaw projecting slightly beyond the lower; nostrils superolateral, very slightly projecting, their distance from end of snout slightly less than half their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis not distinct; loreal region flat. Eye large, prominent, its diameter equal to its distance from end of snout; interorbital diameter a little less than 1½ times the width of the moderately broad upper eyelid, about 1⅔ times the distance between nostrils. Tympanum fairly distinct except for its upper margin, which is obscured by the dorsal skin, about two-fifths the diameter of eye, separated from eye by an interval equal to its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching to disk of third, which covers the tympanic area; no rudiment of pollex visible; toes three-fourths webbed, third slightly longer than fifth, disk of fourth covering about two-thirds the tympanic area; a distinct small inner but no outer metatarsal tubercle; no tarsal ridge; no dermal appendage on heel. Body very elongate, in the postaxillary region somewhat narrower than greatest diameter of head. When hind leg is adpressed, heel reaches barely to anterior corner of eye; when limbs are laid along the side, knee and elbow barely touch; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts smooth; an ill-defined glandular ridge above tympanum; skin of throat and chest smooth, of belly very coarsely granular, of lower femur smooth except for a few indistinct granulations from the vent midway to its distal part. Traces of a slight skinfold across the chest. (A very large median external vocal sac in the male.)

Dimensions.—Head and body 20 mm.; head length 6 mm., width 6 mm.; femur 9 mm.; tibia 10 mm.; foot 7 mm.; hand 5 mm.

Color in alcohol.—The specimen described has faded to a dull smoke-gray above and below, slightly lighter on femur, slightly darker along the sides from tympanum to groin and considerably darker on snout, hands and feet.

In one of two freshly preserved specimens (USNM 103619–20) the dorsum is pinkish Isabella color with darker spots; the venter olive-buff; the iris gray (?). The other is olive-buff above and below, with characteristic dark spots on back and limbs. Both have a dark lateral stripe.

Color in life.—From sketch by Sandig of an adult female (USNM 96861). Dorsal ground color wax yellow, with some very minute gray dots sprinkled over head and back; a dark dorsolateral line beginning apparently on the canthus and continuing above the ear and along the side almost to groin; proximal part of femur and upper arm immaculate white, darkening to canary yellow towards knee and elbow; remainder of upper surfaces of arms and legs canary, the webs of the toes white, the disks of toes and fingers orange above. Chin and chest straw yellow, belly white, lower surface of femur cream color; palms of hands and soles of feet pale canary, the disks faintly tinted with orange below. Iris apparently light wax yellow, the pupil black.

Remarks.—*Hyla sanborni* Schmidt and *H. elongata* are very closely related in most of the essential characters, since the critical proportions of the body, the texture of the skin, pattern, size, and general appearance are exceedingly similar. The most apparent difference between the two forms seems to be in the conformation of the snout; in *elongata* the nostrils do not rise distinctly above the rounded surface of the snout and the surface is consequently evenly convex, while in *sanborni* the region surrounding each nostril is swollen into a distinct mound, with a median furrow between the two elevations. Furthermore, the eyelid in *sanborni* is only one-half or three-fifths of the interorbital width, while in *elongata* it is four-fifths or more of the interorbital width. This measurement of eyelid to interorbital width cannot be taken very accurately in such small specimens, but if heads of frogs belonging to both species are placed side by side, the difference between the inner extension of the eyeball is quite apparent.

The original description of *sanborni* states that vomerine teeth are absent. In three paratypes of *sanborni*, USNM 101457–9, the protuberances on which vomerine teeth usually occur can be seen and felt in the mouth. In *elongata*, the vomerine teeth may be small and moderately developed, or larger and quite heavily developed.

Both *sanborni* and *elongata* have rather transparent upper eyelids, which allow the dark eyeball to be seen through the skin (in preserved examples, at least). *H. nana*, on the contrary, has opaque eyelids which entirely conceal the dark eyeball.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, ZSBS (4), A. Lutz, 1932.

Minas Gerais: Bello Horizonte, USNM 96957–62 (cotypes of *H. elongata*), A. Lutz and Venancio, November–December 1924.

Santa Catarina: Ouro Verde, ZSBS (4), Löffler, Nov. 15, 1927. São Leopoldo, near Nova Teutonia, USNM 103619–20, F. Plaumann, November 1937.

São Paulo: USNM 102301, MP 576. Itapetininga, USNM 102283. São Paulo, Aviation Field, USNM 96861–3 (cotypes of *H. elongata*), B. Lutz, January 1924. Ypiranga, MP 124. Terceira Repressa, ZSBS (10), Schindler, Dec. 26–31, 1937.

Hyla goughi goughi E. G. Boulenger

Figure 12

1911. *Hyla goughi* E. G. Boulenger, p. 1082, pl. 64, upper figure (type locality, Trinidad).—Nieden, 1923, p. 311.—Parker, 1933, pp. 9, 11; 1934c, p. 123.

Description.—Adult male, USNM 97308, Manguinhos, near city of Rio de Janeiro. Vomerine teeth in two long, posteriorly-converging series arising in front of the anterior borders of the choanae and terminating near the midline and slightly anterior to an imaginary line connecting the posterior borders of the choanae; these vomerine teeth appear rather poorly defined, as they are nearly covered by the skin of the interior of the mouth; tongue less than half as wide as mouth-opening, nearly circular except for a deep notch on its free posterior border; snout rather short and rounded when viewed from above, truncate in profile, the upper jaw scarcely projecting beyond the lower; nostrils superolateral, scarcely projecting, their distance from end of snout about half that to anterior border of eye, separated from each other by an interval very slightly less than their distance from eye. Canthus rostralis not defined; loreal region flat. Eye relatively large, very prominent, its diameter greater than its distance from end of snout; interorbital diameter about 1⅓ times the width of upper eyelid, considerably greater than distance between nostrils. Tympanum very distinct, about one-half the diameter of the eye, separated from the eye by a distance slightly exceeding its own diameter. Fingers one-third webbed, fourth much longer than second and reaching to base of disk of third, which covers the tympanic area; no pronounced rudiment of pollex; toes three-fourths webbed, third and fifth subequal; disk of fourth toe covering about one-half the tympanic area; a distinct projecting inner tubercle at base of first toe, but no apparent outer metatarsal tubercle; no inner tarsal ridge and only a very weak outer one; no dermal appendage on heel; body somewhat elongate, in the postaxillary region a little wider than greatest width of head; when hind leg is adpressed, heel reaches anterior corner of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels considerably overlap; skin of upper parts smooth; scarcely any trace of a glandular supratympanic ridge; skin of throat and chest very finely pustular to smooth, belly and infra-anal region coarsely granular. A skinfold across the chest. A pair of prominent external vocal sacs.

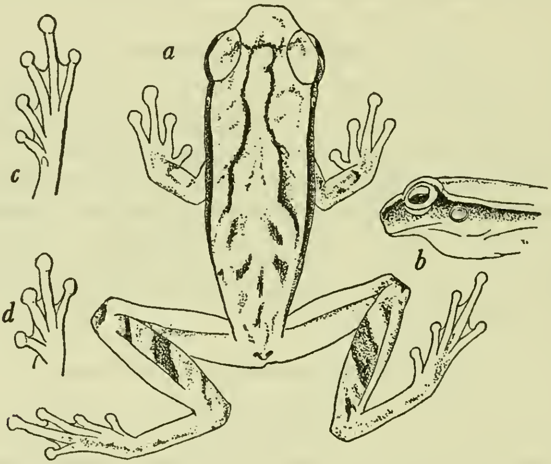


FIGURE 12.—*Hyla goughi goughi*, USNM 97308: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × 2½.

Dimensions.—Head and body 18.5 mm.; head length 6 mm., width 6 mm.; femur 8 mm.; tibia 9 mm.; foot 7.5 mm.; hand 5.5 mm.

Color in alcohol.—Upper parts of head and back drab; a pair of very narrow black lines between the eyes proceeding backwards past the occipital region and there diverging and becoming more or less indistinct towards the sacral region; a few dark spots between these paired lines on the posterior part of the body; a wide chocolate band beginning at the snout, passing through the loreal region, lightening on the tympanum, darkening above the shoulder, and finally diminishing to a number of small round dots towards the groin; a very narrow, pale line bordering it above, widening on the outer part of the upper eyelid and blending with the drab dorsal tone behind the tympanum. Femur above and below immaculate pale cream-buff. Upper parts of tibia, as well as forearm, pale clay color, with several diagonal chocolate crossbars; outer surface of tarsus and foot with a few dark brown dots. Entire ventral surface immaculate olive-buff. Anal region with a dark patch bordered above by a lighter crescentic mark.

Color in life.—On a series of eight living examples from Manguinhos, collected on January 23, 1935, the following color notes were taken: Dorsum maize yellow. Upper tibia chrome yellow. A few gray spots and stripes on back. Throat deep chrome; belly pale sulphur yellow; limbs below cream color, deepening on digits to pale buff-yellow. Tibia and tarsus pale pinkish cream. Iris chrome yellow at periphery, minutely flecked with brown centrally. Pupil horizontally elliptic.

Variations.—The females appear to attain a larger size than males, as is the case in most species of frogs; USNM 97300, one of the largest females, is 23 mm. long. The heel occasionally reaches the tip of the snout. In color there is not much variability, the same characteristic narrow ( )-shaped dark lines appearing on the back of every unfaded specimen. In addition to this pattern, a few of the specimens have a trace of a median light stripe edged by dark markings or spots on the sacral region, and sometimes a fine powdering of dark dots occurs all over the dorsal ground color.

In the series of over 40 individuals of this rather common species taken near or in the city of Rio de Janeiro, the structural variation is not very great. The relatively large eye and short snout is noticeable in every specimen, although in a few the tip of the snout is a little more pointed than is generally the rule. The fourth toe is rather long, and projects far beyond the rather weak web, while the fingers are likewise long and slender. The heel in most cases reaches to the center or anterior corner of the eye, but in the large adult female, USNM 97298, it comes no further than the tympanum. A fully developed male measures 20 mm., and smaller ones have vocal pouches well in evidence. The color pattern differs in intensity, but is always essentially the same in its elements: A pair of narrow dark lines beginning at each side of the interorbital region, often continued outward onto the upper eyelid, continuing backwards and parallel to the occiput, and then gradually diverging and usually fading out at the dorsolateral region about at midbody; behind these lines, a pair of short longitudinal lines near the center of the back at the sacral region; a narrow brown stripe from the nostrils extending along the sides nearly to the groin; distinct, wide, diagonal brown bars on forearm and tibia; femur and upper arm entirely immaculate; a few dark postanal spots, and a fine irregular sprinkling of dots often over the entire back, tibia, and tarsus; ventral surface pale and immaculate. Except for the occasional reduction of the pattern of lines into a less distinct series of dots, there is very little change in color in this fairly adequate series.

Two individuals from Pirapora, Minas Gerais, disagree with the Rio de Janeiro frogs in having a distinct white dorsolateral stripe from posterior corner of eye to groin, a slight anterior continuation of it being visible on the canthus rostralis. The dorsal pattern is also much reduced, so that an irregular series of pale tan dots is all that remains of it. Otherwise these specimens are like the others just mentioned.

This series of Rio de Janeiro specimens was compared with the type of *Hyla goughi* by H. W. Parker, British Museum (Natural History). He noted that they agree very closely indeed with *goughi*, saying, "I suspect they are really conspecific. The only difference appears to be in color pattern." His sketch of *goughi* from Trinidad shows a secondary crossbar between the anterior borders of the upper eyelids, which region is usually immaculate, or at most finely dotted, in the Rio de Janeiro frogs. His examination of the Pirapora specimens led him to believe they were a color phase of the Rio de Janeiro form, but more material is needed to see whether the white dorsolateral stripe is constant in the Pirapora form. If so, it may eventually require a subspecific designation.

Remarks.—A small species also found at various localities in the Federal District, less common than *Hyla goughi* but somewhat resembling it, is *H. decipiens.* It can be told from *goughi* by its much smaller eye and by its relatively short fourth toe and fuller webs. Its thick dorsal skin in life has a golden metallic luster which is never found in *goughi*, and even in preserved specimens the difference in integument can usually be noted. Often *decipiens* has a dorsal pattern of dark, posteriorly diverging lines highly suggestive of *goughi*, and with the immaculate femur and belly found in both species, and their similar size, they may be very easy to confuse.

H. nana, found in Minas Gerais, not far south of Pirapora, has likewise the dorsal pattern of diverging lines and is small in size, but its extremely pointed snout, narrow head, and projecting upper jaw, will separate it from either *decipiens* or *goughi*, both of which have blunt snouts, wide heads, and slightly projecting upper jaws.

One of the color patterns of *Hyla minuta*, consisting of elongate stripes that diverge posteriorly, may be confused with *goughi*.

One of the females caught at Manguinhos on January 23, 1935, deposited a mass of about 40 eggs, which swelled in water so that the total diameter was about 2.5 mm., the early embryo itself at this stage being about 1.5 mm. long. The egg-laying begins in September and October. The call is a high-pitched *Trik-trik,—trik.* The species is common near the city of Rio de Janeiro.

Specimens examined

BRAZIL:

Districto Federal: Bom Successo, USNM 96182–93, A. Lutz, 1926–28. Manguinhos, USNM 97292–309, 97311, Venancio, Jan. 23–Feb. 11, 1935. Recreio dos Bandeirantes, USNM 97577, B. Lutz, Cochran, and Venancio, Feb. 9, 1935. Rio de Janeiro, USNM 81106–9, A. Lutz; ZSBS (1), A. Lutz, 1923; MHNP 474, Gallot. Santa Alexandrina, USNM 96380–2, Aug. 1923. Surupuhy, USNM 97398, Cochran, Dias, and Venancio, Mar. 6, 1935. Swamp, 40 km. southwest of Rio de Janeiro, USNM 97562, A. Lutz, Cochran, and Venancio. Feb. 20, 1935.

Minas Gerais: Lagôa Santa, NHMW 554. Pirapora, USNM 98259-60, Cochran, Dias, and Venancio, Mar. 22, 1935.

Pernambuco: Bonito, MZUM 47210 (2).

Rio de Janeiro: Baixada Fluminense, MZUM 104133, Bailey, 1941. Merity, USNM 96233, July 9, 1923. Sacco São Francisco, near Nitérói, USNM 96405–6, Apr. 21, 1923.

São Paulo: Butantan, USNM 96869–70, Fisher, Feb. 27, 1922. São Paulo, DZSP 2954–8, Bokermann, Sept. 30, 1947.

TRINIDAD: BM 1911.9.8.5 (type of *H. goughi*), Gough.

***Hyla goughi baileyi* Cochran**

Figure 13

1953. *Hyla goughi baileyi* Cochran, p. 114 (type locality, Fazenda Poco Grande, 8 km. north of Juquiá, São Paulo).

Description.—The original description is reproduced here:

Description of the type: MZUM 106737, an adult male from Fazenda Poco Grande, 8 Km. north of Juquiá, São Paulo, collected by Joseph R. Bailey, Feb. 25–28, 1941. Vomerine teeth in two round, distinct, well-separated patches between the choanae; tongue a little more than ½ as wide as mouth opening, nearly round, with a slight indentation on its free posterior border; snout quite short, rounded at the tip when viewed from above and in profile; upper jaw projecting considerably beyond the lower; nostrils superolateral, their distance from snout about half that from anterior corner of eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded; loreal region flat. Eye relatively large, very prominent, its diameter slightly greater than its distance from end of snout; interorbital diameter about 1⅓ times the width of upper eyelid, slightly greater than distance between nostrils. Tympanum distinct, about ½ the diameter of the eye, separated from eye by a distance equal to ½ its own diameter. Fingers ⅓ webbed, 4th much longer than 2nd, and reaching to base of disk of 3rd, which covers about ⅘ the tympanic area; a semicircular knob at base of 1st finger representing a rudiment of a pollex; toes ¾ webbed, 3rd and 5th subequal, reaching to base of penultimate phalanx of 4th, whose disk covers about ½ the tympanic area; a prominent oval inner and a very small, round, outer metatarsal tubercle; no inner or outer tarsal ridges; no dermal heel appendage. Body elongate, in post-axillary region narrower than greatest width of head. When hind leg is adpressed, heel reaches anterior corner of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to the body, heels touch. Skin smooth above, except for a few scattered pustules. A prominent median external vocal sac in the male.

Dimensions: Head and body, 20.5 mm.; head length, 6.5 mm.; head width, 6.5 mm.; femur, 9 mm.; tibia, 10 mm.; foot, 9 mm.; hand, 6 mm.

Color in alcohol: Dorsum pinkish buff, powdered everywhere with minute dark dots; a drab crossband between the eyes; a pair of short, dark)(-shaped lines from eyes to anterior part of back, with a few black spots scattered throughout their length; a dark dorsolateral band beginning at tip of snout, continuing behind eye and fading out just before groin; a single silvery white semicircular spot on upper lip below anterior corner of eye; a white Y-shaped mark on front of snout, the upper branches extending along canthus to eye; 2 or 3 faint diagonal crossbars on forearm, a larger dark patch on elbow and a short mark on anterior part of upper arm; femur, tarsus and foot with minute dark dots above; posterior femur immaculate; a dark knee patch; tibia with 3 faint crossbars. Venter pale buff, immaculate. . . .

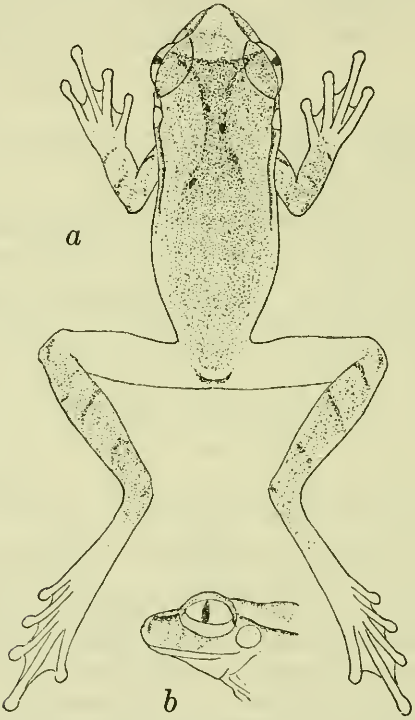


Figure 13.—*Hyla goughi baileyi*, MZUM 106737 (type): *a*, Dorsum; *b*, profile; both × 2.

Remarks: The largest male has a total length of 21.5 mm.; the single female measures 23 mm. The silvery spot on the upper lip which characterizes this subspecies is very distinct in all except one frog, where only a trace of the marking appears. A similar white spot in the same place appears in another member of the group of minute frogs, a subspecies which I named *Hyla bipunctata branneri*, from Pernambuco (Journ. Washington Acad. Sci. v. 38, No. 9, 1948, p. 316).

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	23	23	23	23	23	23
Mean	31. 1	31. 5	44. 4	49. 7	42. 5	29. 5
Standard deviation	1. 19	1. 91	2. 31	1. 83	2. 79	1. 57
Variation	3. 8	6. 1	5. 2	3. 7	6. 6	5. 3
Standard error	. 25	. 40	. 48	. 38	. 58	. 33
Range	28. 2–34. 2	28. 2–36. 8	39. 0–47. 3	46. 4–54. 3	38. 3–47. 3	26. 5–32. 3

BRAZIL:

São Paulo: Juquiá, 8 km. north of, MZUM 106737 (type), and 104119, 104127, 104131, USNM 132913–6 (all paratypes), Bailey, Feb. 25–28, 1941.

Hyla leucophyllata (Beireis)

Plate 9, Figures a–d

1783. *Rana leucophyllata* Beireis, p. 182, pl. 11, fig. 4 (type locality, Surinam).—Bonnaterre, 1789, p. 2, pl. 4, fig. 4.—Shaw, 1802, p. 127.
1789. *Rana leucophylla* Gmelin, p. 1055.
1789. *Rana variegata* Bonnaterre, p. 8.
1799. *Calamita leucophyllata* Schneider, p. 168.
1802. *Hyla frontalis* Daudin, 1802, p. 24, pl. 7, figs. 1, 2; 1803, p. 45.
1820. *Calamita leucophyllatus* Merrem, p. 173.
1824. *Hyla elegans* Wied, 1824b, p. 671 (type locality, Ponte de Gentio on Rio Alcobaça); 1824a, pl. 85, fig. 1; 1825, p. 529.
1829. *Hyla leucophyllata* Gravenhorst, p. 31.—Duméril and Bibron, 1841, p. 607.—Günther, 1858, p. 112; 1901, p. 277.—Steindachner, 1864a, p. 243.—Cope, 1868, p. 111; 1870, p. 156; 1871b, p. 222; 1874, p. 122.—Boulenger, 1882a, p. 387.—Boettger, 1892, p. 44.—Baumann, 1912, p. 163.—Nieden, 1923, p. 259.—Cott, 1926, p. 1160.—Miranda-Ribeiro, 1926, p. 73, pl. 10, figs. 3, 3a.—Mertens, 1930, p. 162.—deWitte, 1930a, p. 227.—Krieg and Forster, 1937, p. 292, fig. 6.—Myers, 1946, pp. 13, 31.—Mertens, 1950, p. 187, fig. 9.
1838. *Hypsiboas leucophyllatus* Tschudi, p. 72.
1843. *Dendroscophus frontalis* Fitzinger, p. 31.
1869. *Hyla triangulum* Günther, p. 489, pl. 38, fig. 4 (type locality, Brazil).
1870. *Hyla leucophyllata triangulum* Cope, p. 55.
1935. *Hyla leucophyllata sarayacuensis* Shreve, p. 215 (type locality, Sara-yacu, Ecuador).

Description.—Adult male, USNM 97358, Manguinhos, near city of Rio de Janeiro. Vomerine teeth in two very small, weak, well-separated patches between the rather small choanae; tongue one-half the width of mouth-opening, nearly circular except for a slight notch on its free posterior border; snout very short and bluntly rounded when viewed from above, truncate in profile, the upper jaw slightly projecting beyond the lower; nostrils more superior than lateral, not projecting, their distance from end of snout about half that to anterior border of eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis not well defined; loreal region slightly concave, nearly vertical. Eye quite large and prominent, its diameter greater than its distance from tip of snout; interorbital diameter equal to width of upper eyelid, considerably greater than distance between nostrils. Tympanum fairly distinct but very small, about one-third the diameter of eye, separated from eye by an interval equal to about half its own diameter. Fingers one-third webbed, fourth much longer than second and reaching to base of disk of third, which amply covers the tympanic area; no pronounced rudiment of a pollex; toes three-fourths webbed, third and fifth subequal, disk of fourth toe almost covering the tympanic area; a distinct projecting inner but no apparent outer metatarsal tubercle; a very heavy and distinct ridge along inner side of tarsus; no dermal appendage on heel. Body somewhat elongate, in postaxillary region slightly narrower than greatest diameter of head. When hind leg is adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts smooth; a very slight, short, glandular swelling above the ear taking the place of a dermal ridge; skin of throat and chest smooth, of belly coarsely granular, of thighs very finely granular. A slight skinfold on sides of chest in front of axilla. A very large median external vocal sac.

Dimensions.—Head and body 27 mm.; head length 8 mm., width 9 mm.; femur 13 mm.; tibia 14 mm.; foot 12 mm.; hand 8 mm.

Color in alcohol.—Sides drab to olive; an opalescent white dorsal area beginning at tip of snout, widening anteriorly to include the upper eyelids, narrowing on the sacral region and ending in a point above the anus; a dark-edged, elongate rectangular spot of olive ground-color invading the center of this white area; upper limb surfaces including femur drab, with a small, brilliantly opalescent white spot above each elbow, and a much larger white spot covering the entire upper part of the tibia, the demarcation between white area and ground-color emphasized everywhere by a dark line; ventral surface clay color, belly slightly ochraceous.

Color in life.—An adult female, USNM 97353, was brought to the laboratory at Manguinhos on January 23, 1935. During the night it deposited eggs. On the following day these color notes were taken: A median walnut brown patch on anterior part of back surrounded by a larger olive patch in which there are some very small cream-color dots. Below this is a lateral band of reddish walnut brown. A pair of minute lemon spots on elbow. Femur brilliant Saturn red. Tibia with an olive-and-cream patch above like that on the back. Tarsus orange vermilion; webs and toes and also sole of foot brilliant scarlet vermilion. Venter lemon yellow, underside of limbs orpiment orange. Iris brassy, with many fine purplish brown spots. Pupil contracted to a horizontal slit edged with gold. A pair of minute lemon spots on elbow.

A male, USNM 97354, taken with the female, was quite similar in color, but the following differences were noted: Venter a little paler. Central dorsal patch dark raw umber, surrounded by light russet. Lateral stripe cinnamon-rufous. Upper femur ochre yellow. Eye similar to that of female, but pupil less contracted, a more perfect ellipse.

Variations.—In this extremely widespread species, it is interesting to note how the variable features coincide even in two series so widely separated as one from Costa Rica and one from Rio de Janeiro. In the series from Costa Rica five adults, 3 females and 2 males, were taken for measurement. In these the heel may reach to center of eye, to tip of snout, or beyond the snout. The same variability occurs in the series of 18 adults and young from the State of Rio de Janeiro. When reduced to measurement, the femur is 45 to 56 percent of the total head and body length in the Costa Rican frogs, and 42 to 54 percent in the Rio de Janeiro specimens. The tibia measures from 50 to 60 percent of head and body length in the Costa Rican series, and 48 to 57 percent in the Rio specimens. A single adult female from Angostura, Ecuador, USNM 20601, has a short femur and tibia, measuring 44 and 50 percent, respectively, of head and body length.

It appeared at first that the size and distinctness of the tympanum might enable the Central and the South American forms to be differentiated at least as subspecies, but this character also breaks down upon the examination of even a half dozen specimens from either place. The tympanum of the Costa Rican frogs is faint in most examples, but very distinct in one or two, and when easily visible is usually smaller than the largest finger disk. In most of the Rio specimens it is rather distinct, and may be as large as the finger disk, although occasionally smaller. Although the diameter of the tympanum is difficult to gauge in those examples on which it is indistinct, it appears to be about one-third to two-fifths the eye diameter in most of the Costa Rican examples. In the Brazilian examples it is usually about one-half the eye diameter, but occasionally not over one-third the eye diameter. Thus, it does not seem possible to separate the two forms subspecifically on the basis of this feature.

The color pattern is apparently more definite in the Rio form, and less subject to fluctuation, since the brown median dorsal rectangular marking usually maintains its distinct form without any posterior prolongation to form λ-shaped markings on the sacral or lumbar region. But in several Rio examples are invading areas of brown that nearly merge with the lateral dark bands to form this marking supposed to be characteristic of the northern form, and in one example, USNM 76294, from Rio de Janeiro, the pattern is actually completed on one side of the body, this individual resembling the Ecuador frog in this respect. The dorsal pattern in the northern *H. leucophyllata* seems subject to much more irregularity; in some of the Costa Rican frogs it is much reduced in size, very irregular in outline, or even broken up, while in the two examples from Pernambuco, the λ-shaped pattern is complete. Fresh Central American specimens are said to have a light spot below the eye which does not appear to be present in South American examples. In this connection it is interesting to observe that this light spot below the eye occurs in the Guatemalan frog called *Hyla ebraccata* by Taylor and Smith (Proc. U. S. Nat. Mus., vol. 95, p. 587, 1945).

Remarks.—Hyla ebraccata Cope has been revived as a full species by Taylor and Smith. It was synonymized with a query under *leucophyllata* by Boulenger, 1882.

The subspecies *sarayacuensis* described by Shreve from Ecuador on the basis of a melanistic color pattern is synonymized here because of a very similar melanism found especially in USNM 97353, from Manguinhos. In this frog, the silvery areas so obvious in most of its companions are completely overlaid with a chocolate-brown network, so that the silver appears only in small patches on the elbow and along the edges of the upper tibial spot. Less extensive veinings of brown occur on some of the other *leucophyllata* from this and other localities.

In the State of Rio de Janeiro *leucophyllata* is common. The call is a *tick-tick-tick*, repeated often, like that of a small cricket. Tadpoles are found in fresh-water streams, and eggs have been laid in the laboratory at any time between September and January. Adults are found on leaves, in banana trees, and in bromeliads.

I kept a female of this species alive for nearly a year, having brought it from Rio de Janeiro to the U. S. National Museum in Washington, D. C. From early May until November it took no food, clinging constantly to the side of the glass near the water which covered the bottom of the vivarium and apparently not changing its position for days at a time. In November it became active, and some small earthworms, flies and pieces of raw beef were readily eaten when offered. During its prolonged abstinence from food, the frog did not appear to get thinner. Probably the species normally undergoes a long period of inactivity, or "hibernation," after the usual mating season.

The light dorsal areas which appear silvery white in most preserved specimens were brilliant metallic gold in this living specimen, changing sometimes to a dull bronze or almost coppery hue for a few days.

The legs and ventral region were gamboge yellow, and the feet were orange.

Specimens examined

BRAZIL: ZSBS 1174/0, Martius; MHNP 4866, Vautier; MHNP 4869 (3), Gaudichaud; MHNP 86-128, Montandon.
AMAZONAS: Manacapuri-Solimões, ZSBS 34/1924, Erhardt, Nov. 15, 1924.
BAHIA: Bahia, MP 273.
DISTRICTO FEDERAL: Bom Successo, USNM 96204-6, A. Lutz, Feb. 2, 1925. Manguinhos, USNM 96140-3, A. Lutz, Feb. 12, 1923; USNM 97353-8 and 101130, Venancio, January-May, 1935, IB 120 (5). Rio de Janeiro, USNM 76294, A. Lutz; USNM 123575, B. Lutz, December 1940. Quinta do Imperador, USNM 96398, A. Lutz, Feb. 27, 1921.
MINAS GERAIS: MP 267. Marianna, MP 704.
PARÁ: BM 1926.9.18.1, Moss.
PERNAMBUCO, Zona da Matta, USNM 97093, Pickel, October 1926.
RIO DE JANEIRO: Angra dos Reis, USNM 70522-4, Metcalf, Oct. 15, 1925.
ECUADOR: Angostura, USNM 20601, Kerr, Feb. 2, 1893. Tanayen, ZMB 72.10173 and 72.10174 (2), Buckley.
FRENCH GUIANA: Cayenne, MHNP 4865 (2), Leprieur.
SURINAM: ZMB 27056 and 27133, Heller; MHNP 4868, Levaillant. Paramaribo, ZSBS 56/1925, Fritsche, 1924.

Hyla minuta Peters

PLATES 9, FIGURES E-H, 10, FIGURES A-F

1872. *Hyla minuta* PETERS, 1872a, p. 680 (type locality, near Rio de Janeiro).—BOULENGER, 1882a, p. 389.—BAUMANN, 1912, p. 163.—NIEDEN, 1923, p. 287.—MIRANDA-RIBEIRO, 1926, p. 89.—MERTENS, 1928, p. 298.—MYERS, 1946, pp. 13, 31.
1887. *Hyla velata* COPE, p. 46 (type locality, Chapada, Mato Grosso).—BAUMANN, 1912, p. 163.—NIEDEN, 1923, p. 289.—MIRANDO-RIBEIRO, 1926, p. 91.
1888. *Hyla bivittata* BOULENGER, 1888a, p. 188 (type locality, Lages, Santa Catarina); 1888c, p. 417; 1890, p. 326; 1891b, p. 456.—NIEDEN, 1923, p. 294.—MIRANDA-RIBEIRO, 1926, p. 82.—DEWITTE, 1930a, p. 227.
1912. *Hyla bisittata* (sic) BAUMANN, p. 163.
1925. *Hyla pallens* A. LUTZ, 1925b, p. 212 (type locality, marshes in Rio and neighboring States); 1926a, pp. 7, 14.—MERTENS, 1929, p. 287.—MYERS, 1946, pp. 12, 30.
1927. *Hyla emrichi* MERTENS, p. 1, figs. 1, 2 (type locality, Montserrat, near Pôrto Alegre, Rio Grande do Sul).
1926. *Hyla suturata* MIRANDA-RIBEIRO, p. 93, pl. 10, figs. 5-5b (type locality, Teresópolis, Rio de Janeiro).

Description.—Young female, ZMB 7300 (part; cotype of *H. minuta*), city of Rio de Janeiro. Vomerine teeth in two moderately long, well-separated, fairly heavy patches, slightly convergent posteriorly, lying partly between and behind the choanae; tongue a little more than half the width of mouth-opening, broadly cordiform with a distinct median notch in its free posterior border, and a posterior median groove; snout short and rounded when viewed from above, sloping forwards to the lip border when viewed in profile, the upper jaw scarcely projecting beyond the lower; nostrils superolateral, scarcely projecting, their distance from end of snout about three-fourths that from eye. Canthus rostralis scarcely defined; loreal region flat. Eye large and prominent, its diameter equal to its distance from end of snout; interorbital diameter 1⅓ times that of upper eyelid, a little greater than width between nostrils. Tympanum indistinct, only faintly visible as a flattened area beneath skin of side of head, apparently about one-half the diameter of eye, separated from eye by a distance equal to about half its own diameter. Fingers a little less than one-third webbed, fourth considerably longer than second, reaching to disk of third, which covers nearly the entire tympanic area; no projecting rudiment of a pollex; toes three-fourths webbed, third and fifth subequal, disk of fourth covering about three-fourths the tympanic area; a distinct small inner but no outer metatarsal tubercle; no distinct raised tarsal fold; no dermal appendage on heel but a faint dermal ridge across it. Body somewhat elongate, in the postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts very finely glandular, with a few minute pustules on top of head; a rather weak glandular ridge above the tympanic area, soon terminating on the shoulder. Skin of chin smooth, that of throat and chest finely glandular, that of belly and lower femur coarsely granular. A slight skinfold across chest. (An external median vocal sac in the male.)

Dimensions.—USNM 96198 (cotype of *H. pallens*): Head and body 19 mm.; head length 6.5 mm., width 7 mm.; femur 9 mm.; tibia 10.5 mm.; foot 8.5 mm.; hand 5.5 mm.

Color in alcohol.—Ground color above pale ecru-drab; a darker drab longitudinal hourglass-shaped mark beginning on the head between the eyes, its narrowed part above the arm insertion, and its posterior widened part prolonged outwards and backwards on each side for a short distance ending midway between axilla and groin; a pair of rounded drab spots on the sacral region more or less confluent with the posterior prolongation of the hourglass-shaped mark, and another fainter, smaller pair of round spots behind them; forearm faintly and tibia distinctly marked with drab crossbands; all drab marks on body and limbs outlined very distinctly with a narrow white line, which appears also along the canthus rostralis and along the outside of tarsus, crossing the heel, and emphasizing the dark area on underside of foot. Femur immaculate. Ventral surface pale ecru drab to pale vinaceous, immaculate. A white line followed by a small dark patch in front of anus.

Color in life.—On three living frogs from Manguinhos collected on January 25, 1935, the following color notes were taken on the same day: Dorsum pinkish buff, immaculate. Fingers primrose to maize yellow. Toes pale chrome yellow. Venter in one example pale cream color, in the other two with pale lemon hues. Limbs vinaceous-buff, almost transparent. Iris silvery tinged with pink and other iridescent colors, with many fine brown lines. Belly on sides transparent, opaque in center.

Variations.—The second cotype, also a female, is slightly heavier in build than the one described but resembles it closely in all essentials; the dark hourglass pattern is very evident, although not quite so perfect, and the narrow white outline is lacking. The white line appears, however, very conspicuously above the dark anal patch and also across the heel. The light immaculate femur is a constant feature. The tympanum is scarcely more visible than in the described frog, but the glandular ridge above it is more prominent.

Even with the few specimens at hand from near the city of Rio de Janeiro, a considerable degree of variation is evidenced in the topotypes of *H. pallens.* The vomerine teeth may be between the posterior halves of the choanae, or entirely behind the level of their posterior borders. The teeth may be heavy or moderate in development, in either short transverse series or in longer, posteriorly converging ones. The heel reaches sometimes to the nostril, sometimes to the end of the snout. The tympanum may be most perceptible at its upper margin, or the anterior margin may project most above the skin which rather effectively veils the entire organ.

The color pattern is more or less constant in having as its element the three widened transverse crescents, the anterior two of which may anastomose to form an X-shaped mark, but which apparently never form longitudinal stripes posteriorly in the Manguinhos form, as they do in Bello Horizonte.

Remarks.—This small and perplexing species has given rise to great confusion in collections, owing to the insufficiency of Peters' original description and the lack of any figure of the cotypes. My comparison of his cotypes with cotypes of *H. pallens* Lutz reveals, however, that they are of the same species. Likewise, a close comparison of his cotypes and an example labeled *H. bivittata* Boulenger, from the British Museum, has led me to the conclusion that the two names are synonymous in spite of the apparently very dissimilar color pattern found in extreme individuals. No single structural feature serves to keep the species apart, nor any combination of characters, when a series of more than two or three individuals is thoroughly examined. In a series of 12 specimens from the Serra da Bocaina (USNM 96569–80) both color patterns are present in the extremes in about equal numbers, while a few of the examples show a tendency towards intergrading patterns. Some of these specimens have the fingers webbed only at the base; others have the fingers a little less than one-third webbed. The length and shape of the snout varies even in this small series. In another larger series from Bello Horizonte, Minas Gerais, the *bivittata* coloration predominates, but occasional specimens show the extreme *minuta* pattern, while a good many pattern intergrades are present, as well as considerable variation in the webbing of fingers and toes, length of femur, visibility of tympanum, shape of snout, and other supposedly stable characters.

A point-by-point checking of a cotype of *minuta* with the British Museum specimen of *bivittata* shows only rather trivial differences in the latter: Tongue two-thirds the width of mouth-opening; snout moderate in length; distance of nostrils from end of snout about one-half that from eye; tympanum fairly distinct, about two-fifths the diameter of the eye; fingers webbed only at their base, disk of third covering one-half the tympanic area; toes a little more than one-half webbed, disk of fourth covering one-half the tympanic area; when limbs are laid along the sides, knee and elbow overlap. The elongate dark markings on the side of the back of the British Museum example suggested a name for this form to Boulenger, who was apparently unaware of the extreme variability of *minuta*.

While specimens of unknown parentage cannot be used to prove a real genetic proportion, there are sufficient specimens to permit some correlation of color pattern with locality.

The three patterns found in *H. minuta* may be described as follows: *a*, A dark, white-bordered triangle on the head, its apex directed posteriorly; a larger dark triangle touching the first, and with its apex directed anteriorly; usually a crescentic or irregular marking behind these triangles across lower sacral region; *b*, a dark squarish mark on head, with its two posterior angles prolonged posteriorly into two slightly diverging longitudinal stripes; *c*, heavy dark dots on the back from between eyes to lower sacral region.

Pattern *a* is found on frogs from Pernambuco, Minas Gerais, Rio de Janeiro, and Bolivia; *b*, on frogs from Pernambuco, Minas Gerais, Rio de Janeiro, São Paulo, and Santa Catarina; and *c*, only on frogs from Rio de Janeiro (in two instances it seemed to overlay pattern *b*). Frogs having pattern *a* were more numerous than those having pattern *b* in Pernambuco, Minas Gerais, and Rio de Janeiro; whereas pattern *b* was dominant in frogs from São Paulo and Santa Catarina.

In frogs from the north and west (Bolivia) pattern *a* tended to predominate, while in those from the south pattern *b* predominated. Those from the most central of the three northern states, Rio de Janeiro, had the greatest proportion of *b* to *a* (9 to 24).

Examination of large numbers of this puzzling small species prompts a few general observations: Many of these frogs have the nostrils located in a projecting bulge, with a furrow between, giving the sinuous outline to the snout, when viewed from above and behind, characteristic of *Hyla sanborni* Schmidt.

A pair of elongate air-sacs could be seen in the dorsolateral region on certain specimens. They extended from in front of the shoulder practically to the groin. In some preservations these stain a pinkish or light brown color.

The bubblelike median vocal sac of the male is large and obvious. It is heavily plicate, and even in young males in which it is not well developed, the little folds on the sides are visible. While the sac is described as "median" it is almost a semicircle across the throat, as its outer folds begin just below the tympani.

The tibia is relatively thick in this species, although not quite so much so as in the *rubra* group. The femur is uniformly immaculate. The dorsal pattern is subject to great variation, being sometimes a scattering of large dots, but often a series of fairly regular, white-outlined spots of characteristic shape. Occasionally it is lacking.

The snout is usually blunt or rounded; this feature varies a great deal also.

There is little disparity in the maximum size of the two sexes, the largest Brazilian female being 25.5 mm. in head and body length, and the largest male 26.5 mm. This condition is very unusual among amphibians, where the female is usually larger.

The males greatly predominate in collections, as much as 24 to 1 in the Bello Horizonte collection. It is uncertain whether they also outnumber the females in nature, or are more apparent because of their calling, or so fearless during breeding time that they can be picked up more easily.

Many more frogs, and from many more localities than those now at hand, must be studied before the limits of variation of this species can be accurately ascertained.

Specimens examined

BRAZIL: BM RR 1936.12.3.194–5, Lord Stuart; UZMK 61.

AMAZONAS: Upper Amazon, BM 91.9.24.43, Bartlett.

DISTRICTO FEDERAL: Bom Successo, USNM 96197–8 (cotypes of *H. pallens*), A. Lutz, Sept. 2, 1923; USNM 96199 (cotype of *H. pallens*), A. Lutz, Aug. 6, 1921; USNM 96195–6. Manguinhos, USNM 97359, Venancio, Jan. 28, 1935; USNM 97365–73, Venancio, Feb. 11, 1935. Rio de Janeiro, ZMB 7300 (2; cotypes of *H. minuta*); MZUM 64148 (7), 63344; USNM 70525–30, Metcalf, Oct. 11–17, 1925. Santa Alexandrina, USNM 96378–9, A. Lutz, Aug. 30, 1923. Tijuca, USNM 96257, A. Lutz, Feb. 2, 1920.

MINAS GERAIS: Bello Horizonte, USNM 96950–4, A. Lutz, November 1924; USNM 96972–4, A. Lutz, Dec. 9, 1924; Country Club, near Bello Horizonte, USNM 97861–86, Lisboa, Cochran, and Venancio, Mar. 13, 1935. Lagôa Santa, UZMK 53, Warming.

PERNAMBUCO: Bonito, USNM 48858, Branner. Tapera, USNM 97069–70, 97073, and 97086–7, Pickel.

RIO DE JANEIRO: Barro Branco, MZUM 104152, Bailey, 1941. Bonito, Serra da Bocaina, USNM 96697–704, A. Lutz, Jan. 16–30, 1925. Colonia Alpina, near Teresópolis, BM 93.9.30.7, 93.9.23.5, Goeldi. Serra da Bocaina, USNM 96569–80, A. Lutz, January 1930.

RIO GRANDE DO SUL: Canella, ZSBS (3), Gliesch, 1929. Caracol, BM 1929.11.2.5; ZSBS (4), Emrich, 1928. Estrella, ZSBS (26), Gliesch, May 1926. Montserrat near Pôrto Alegre, ZMB 31084, Adloff. Pôrto Alegre, ZMB 34067, Schroder.

SANTA CATARINA: BM 88.4.23.20–21, Michaelis. Lages, BM 88.2.7.26–31 (cotypes of *H. bivittata*), Michaelis. Ouro Verde, ZSBS (10), Löffler, Nov. 15, 1927. Rio Humboldt, BM 1923.6.1.56–63. São Bento, USNM 97155–7, 1923. Teresópolis, BM 88.9.21.19, Fruhstorfer.

SÃO PAULO: Alto da Serra, MRHN IG 9404 Reg. 78, Massart, Oct. 4, 1922. Campo Grande, USNM 102303. Ribeirão Pires, USNM 102297. Rio Grande, USNM 102306. Ypiranga, USNM 102304–5.

ARGENTINA: Misiones, FMNH 9282.

BOLIVIA: Buenavista, Dept. Santa Cruz, USNM 118694–6, Steinbach.

TRINIDAD: BM 1911.9.8.6, Gough. Mount St. Benedet, BM 1934.2.26.28 (cotype of *H. minuta*), Fitzgerald.

Hyla nana Boulenger

FIGURE 14; PLATE 10, FIGURES G–I

1889. *Hyla nana* BOULENGER, p. 249, pl. 2, figs. 2–2a (type locality, Colonia Resistencia, S. Chaco, Argentine); 1890, p. 326; 1891b, p. 456; 1894, p. 348.—BERG, 1896, pp. 151, 207.—BUDGETT, 1899, pp. 305, 328.—PERACCA, 1904a, p. 13.—NIEDEN, 1923, p. 294.—MIRANDA-RIBEIRO, 1926, p. 83; 1937a, p. 56.—MÜLLER and HELLMICH, 1936, p. 65, fig. 23.—MELLO-LEITÃO, 1937, p. 341.—SCHUBART, 1939, p. 52.

Description.—Adult male, USNM 98131, Lagôa do Curralinho near Lassance, Minas Gerais. Vomerine teeth in two moderate, transverse, well-separated series between the anterior halves of the choanae; tongue very large, four-fifths the width of mouth-opening, cordiform and deeply notched behind, free for its entire posterior half; snout elongate, narrow and pointed when viewed from above, pointed at the tip in profile and slanting backwards to the edge of the mouth, upper jaw consequently projecting greatly beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about one-third that to anterior border of eye, separated from each other by an interval nearly equal to their distance from eye. Canthus rostralis very well defined, loreal region very slightly concave and nearly vertical down to the lip border. Eye moderately large, prominent, its diameter equal to its distance from end of snout; interorbital diameter slightly greater than width of the opaque upper eyelid, equal to distance between nostrils. Tympanum rather indistinct, small, about one-third the diameter of eye, separated from eye by an interval nearly equal to its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching to disk of third which apparently covers the tympanic area; no rudiment of a pollex visible; toes one-half webbed, third and fifth subequal, disk of fourth apparently nearly covering the tympanic area; an elongate inner metatarsal tubercle on the side of the foot, but no outer one; inner tarsal ridge extremely weak, outer apparently absent; a heavy skinfold across the heel, but no true dermal appendage; body elongate, in postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches to tympanum; when limbs are laid along the side, knee and elbow are widely separated; when hind legs are bent at right angles to the body, heels overlap. Skin of upper parts smooth; scarcely a trace of a supratympanic ridge; skin of throat and chest smooth, that of belly and postanal region finely granular, that of remainder of lower femur smooth. A heavy skinfold across the chest. An extremely large, longitudinally wrinkled, median, external gular sac, projecting from arc-shaped diverging skinfolds behind and more or less parallel to the lower jawbones, these folds branching posteriorly and ending at the shoulder.

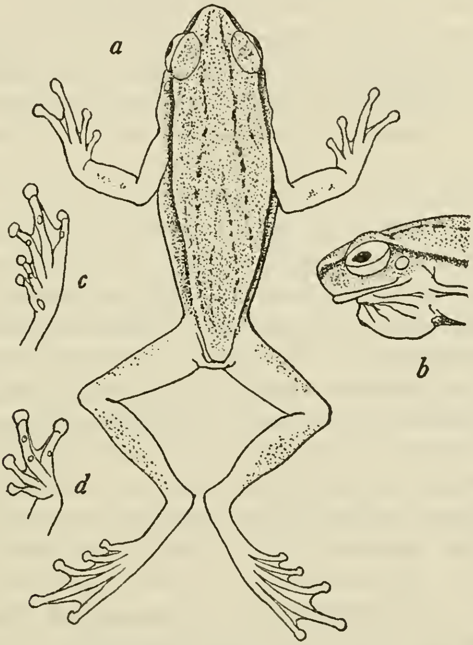


FIGURE 14.—*Hyla nana*, USNM 98131: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × 2½.

Dimensions.—Head and body 20 mm.; head length 6.5 mm., width 6 mm.; femur 8 mm.; tibia 9.5 mm.; foot 7.5 mm.; hand 5.5 mm.

Color in alcohol.—Dorsal ground color light pinkish vinaceous; a pair of fine drab lines beginning at the nostril, continuing parallel to the postorbital region, where they slightly diverge, breaking up into dots and becoming lighter and diverging still more at the center of the back, where they finally fade out; a few drab dots in short, irregular longitudinal series on the sacral region near the midline; a drab dorsolateral line beginning at the tip of the snout, continuing above the tympanum and to the anus, extremely sharp and clean cut on its upper border for its entire extent, and becoming a wide cinereous lateral area below, which merges into the uniform, immaculate, pearl-gray ventral region; entire femur immaculate; upper part of tibia and forearm colored like the back, with irregularly scattered drab dots not arranged in crossbars; feet and hands pale, immaculate; upper lip border pale.

Variations.—The three other specimens from Lassance are also males and do not show much variation from the one described, except that one has the dark dorsal lines much more distinct, while at the same time showing a secondary pair of lines, mostly broken up into dots, which emanates from the upper eyelid and parallels the dark dorsolateral line nearly to the anus. The remaining two specimens show more or less irregular, very light dots in this region, the pattern being scarcely visible. The dorsal ground color becomes much lighter next to the dark dorsolateral stripe, so that the latter appears to be bounded above by a nearly white stripe. The heel in these three Lassance specimens reaches to the posterior corner of the eye.

A fine pair from Bolivia, USNM 101442–3, are identical in structure but slightly larger, the male measuring 22 mm. and the female 26 mm. in total length. The female has a trace of four dorsal dark lines, represented only by widely spaced sepia spots. The male has the central pair of dorsal lines quite plainly marked, but the outer pair is nearly invisible. In neither of these two specimens do the lines diverge, nor are there separate sacral lines or spots.

Remarks.—H. W. Parker has compared two of the Lassance specimens, USNM 98130–1, with the types of *H. nana* in the British Museum (Natural History). He believes them to be conspecific.

Specimens of *H. nana* were collected at Lassance as they sang at night on the aquatic plants growing in the shallow waters of the lagôa in the center of a wide grassy plain near the foothills of the Serra do Cabral. Unfortunately no females or eggs were seen. The adult males when alive are yellowish. They are usually marked like *H. goughi* and like some individuals of *H. decipiens*, but can be told readily from these two by the much narrower head and more pointed snout, which considerably overhangs the lower jaw.

Specimens examined

BRAZIL:
  Minas Gerais: Lagôa do Curralinho, USNM 98130–3, Cochran, Mar. 21, 1935.
BOLIVIA: Buenavista, USNM 101442–3, Steinbach.
PARAGUAY: Alto, ZMB 27066–7, Fiebig. Asunción, NHMH 898, Boblo, 1892.
  San Bernardino, ZMB 27098, Fiebig.

Hyla werneri Cochran

Plate 11, Figures a–d

1894. *Hyla pygmaea* (not of Meyer) Werner, 1894a, p. 411 (type locality, Blumenau, Santa Catarina).—Nieden, 1923, p. 289.
1926. *Hyla pigmaea* (sic) Miranda-Ribeiro, p. 83.—Mello-Leitão, 1937, p. 341.
1952. *Hyla werneri* Cochran, p. 50 (type locality, Humboldt, Santa Catarina).

Description.—Adult male, USNM 66564 (type of *H. werneri*), Humboldt, Santa Catarina. Vomerine teeth in two relatively wide, transverse, narrowly separated patches between the choanae; tongue one-half as wide as mouth-opening, cordiform, with a slight indentation on its free posterior border; snout moderate in length, rounded at the tip when viewed from above, more bluntly rounded in profile, the upper jaw projecting somewhat beyond the lower; nostrils superolateral, somewhat projecting, their distance from end of snout about one-third that from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis very distinct; loreal region slightly concave and practically vertical to the border of the upper lip. Eye large, prominent, its diameter slightly greater than its distance from end of snout; interorbital diameter a little greater than the relatively wide upper eyelid, greater than distance between nostrils. Tympanum very distinct, about two-fifths the diameter of the eye, separated from eye by an interval equal to about one-half its own diameter. Fingers one-third webbed, fourth much longer than second, reaching disk of third which covers the tympanic area; no rudiment of a pollex visible; toes three-fourths webbed, third and fifth subequal, disk of fourth more than covering the tympanic area; a blunt, projecting inner but no outer metatarsal tubercle; apparently a very faint inner tarsal ridge; no outer tarsal ridge; no dermal heel appendage. Body not elongate, in the postaxillary region less than greatest width of head; when hind leg is adpressed, heel reaches anterior corner of eye; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts fairly smooth anteriorly, with a few small pustules on sacral region; a heavy glandular ridge encircling upper part of tympanum and descending diagonally behind it to the axilla; skin of throat and chest smooth, that of belly and lower part of femur coarsely granular; a skinfold across the chest. A very large median external vocal sac.

Dimensions.—Head and body 19 mm.; head length 6.5 mm., width 6 mm.; femur 9 mm.; tibia 10 mm.; foot 8.5 mm.; hand 5.5 mm.

Color in alcohol.—Dorsal ground color cinnamon; a large chocolate spot between the eyes, its anterior border marked off by a row of sepia spots forming a slightly darker crossband between the eyes, its posterior border by a similar, darker, curved band across the nape; a large X-shaped mark composed of small black dots on the anterior half of the back, its anterior prolongations extending to the eyelids, its posterior arms fading out on the dorsolateral region behind the axilla; an aggregation of dark dots making an irregular dark blotch on the sacral region; knee and heel with a dark patch; a heavy crossbar across upper tibia, with a lighter one on each side; forearm with dark crossbars; upper arm with a dark stripe anteriorly; femur immaculate light cinnamon; ventral surface uniform cinnamon.

Variations.—The specimens at hand seem to be constant in both structure and coloration. In one of the females the heel comes barely to the center of the eye; in all others to the anterior corner. Two or three of the specimens have the snout a little flattened at the tip, and the vomerine teeth, while always distinctly visible, are sometimes less strongly developed than in the described specimen. The toes and fingers show about the same degree of webbing and size of disks. The interorbital area is light in some of the specimens, marked off only by the interorbital bar anteriorly and by the converging anterior arms of the dorsal X mark posteriorly. The largest male measures 22 mm. and the largest female the same.

Remarks.—In color pattern this species is somewhat suggestive of *H. nana*, *H. goughi*, and *H. decipiens*. From the first it can easily be distinguished by its much stouter body, and from the two last by its narrower head, and also because its dorsal pattern has a true X shape, instead of being composed of nearly parallel or somewhat diverging lines which do not meet in the midline.

Specimens examined

BRAZIL:

Districto Federal: Manguinhos, USNM 97361–4, Venancio, January 1935.

Santa Catarina: Humboldt, USNM 66564 (type of *H. werneri*), Fritsche, November 1918; USNM 66562–3, 66565–6, 101445–6, 118242 (with same data, all paratypes of *H. werneri*); BM (2); MZUM 58512 (10).

São Paulo: Campo Grande, USNM 102302, Museu Paulista.

5. *rubra*—group

This group of short-legged hylids takes its name from its earliest known species, *Hyla rubra* Daudin, described from the Amazon region, and includes *crospedospila*, *cuspidata*, *fuscomarginata*, *fuscovaria*, *hayii*, *parkeri*, *perpusilla*, *similis*, *squalirostris*, *strigilata brieni*, *strigilata flavoguttata*, and *strigilata strigilata*. In none of these species does the adpressed heel reach beyond the nostril; coarse brown reticulations enclosing yellow or reddish spots are usually found on the concealed surfaces of the legs and groin; and in nearly every one the tibia is noticeably enlarged, almost equaling the heavy femur in diameter. *H. catharinae* Boulenger (1888c, p. 417), from Santa Catarina, is closely related to *H. strigilata brieni*. I include photographs of the type of *catharinae* in plate 13 for comparison.

The group characters are not difficult to recognize, but the specific characters are extremely hard to distinguish, due to their considerable instability. For instance, *hayii* and *nasica* will probably never be completely separated in southern Brazil, since individuals with characters midway between the accepted norms of the two are occasionally found in populations having predominantly the characters of the one or the other. While mathematical analysis is of help in some large series, much work on the variation of broods of known parentage, similar to that on *Eleutherodactylus* by Goin (1950), needs to be done before accurate final results can be achieved.

For a statistical analysis of members of the *rubra* group here discussed, see pages 373 and 378.

Key to the frogs of Group 5 from southeastern Brazil

- a^1. Fingers free.
  - b^1. Vomerine teeth between the choanae.
    - c^1. Nostrils twice as far from eye as from tip of snout; interorbital diameter equals width of upper eyelid; tympanum separated from eye by ½ its diameter; disks of third finger and fourth toe covering ¼ tympanum; size moderate, up to 45 mm. . . . . **fuscovaria** (p. 137)
    - c^2. Nostrils four times as far from eye as from tip of snout; interorbital diameter 1½ times width of upper eyelid; tympanum separated from eye by a distance equaling its own diameter; disk of third finger covering tympanum, of fifth toe covering ¾ tympanum; size small, up to 27 mm. **perpusilla** (p. 145)
  - b^2. Vomerine teeth on level with posterior borders of choanae.
    - c^1. Nostrils three times as far from eye as from tip of snout; interorbital diameter slightly less than width of upper eyelid; disk of third finger covering ⅔ tympanum, of fourth toe more than ½ tympanum; size moderate, up to 40 mm. . . . . **strigilata brieni** (p. 154)
    - c^2. Nostrils twice as far from eye as from tip of snout; interorbital diameter twice width of upper eyelid; disks of third finger and fourth toe covering ⅓ tympanum; size moderate, up to 40 mm. . . . **squalirostris** (p. 151)

a^2. Fingers webbed at the base.
  b^1. Disks of third finger and fourth toe covering ¾ or more of tympanum.
    c^1. Interorbital diameter a little greater than distance between nostrils; tympanum separated from eye by ⅔ its diameter; disks of third finger and fourth toe covering tympanum; size moderate, up to 40 mm. . . **strigilata flavoguttata** (p. 156)
    c^2. Interorbital diameter much greater than distance between nostrils; tympanum separated from eye by ½ its diameter; disks of third finger and fourth toe covering about ¾ tympanum; size moderate, up to 36 mm. . . . . **strigilata strigilata** (p. 158)
  b^2. Disks of third finger and fourth toe covering less than ½ tympanum.
    c^1. Vomerine teeth well separated; size small, up to 26 mm. **parkeri** (p. 143)
    c^2. Vomerine teeth narrowly separated, or almost continuous.
      d^1. Eye not more than ⅔ length of snout.
        e^1. Snout pointed; tympanum separated from eye by ⅔ its diameter; size moderate, up to 41.5 mm. . . . . **crospedospila** (p. 130)
        e^2. Snout rounded; tympanum separated from eye by nearly its own diameter; size rather large, up to 53 mm. . . . . **hayii** (p. 139)
      d^2. Eye more than ⅔ length of snout.
        e^1. Eye equal to length of snout; snout moderately elongate and pointed.
          f^1. Interorbital diameter almost twice distance between nostrils; tympanum distinct; toes ¾ webbed; a small outer metatarsal tubercle present; size small, up to 27 mm. . . . . **cuspidata** (p. 133)
          f^2. Interorbital diameter 1½ times distance between nostrils; tympanum rather indistinct; toes ½ webbed; no outer metatarsal tubercle; size small, up to 29 mm. . **fuscomarginata** (p. 135)
        e^2. Eye equal to ⅚ snout length; snout short, rounded; size moderate, up to 37 mm. . . . . **similis** (p. 148)

Hyla crospedospila A. Lutz

FIGURE 15; PLATE 11, FIGURES E, F

1925. *Hyla crospedospila* A. LUTZ, 1925b, p. 211 (type locality, Rio de Janeiro and São Paulo); 1926a, pp. 6, 13.—MYERS 1946, pp. 12, 29.

Description.—Adult male, USNM 96932 (cotype), Campo Bello, Itatiaia, Rio de Janeiro. Vomerine teeth in two short, heavy, narrowly separated transverse groups between the choanae; tongue about two-thirds as wide as mouth-opening, cordiform and elongate, deeply notched and free behind; snout long and pointed when viewed from above, truncate at the tip and then strongly declivous in profile, the upper jaw projecting greatly beyond the lower; nostrils superolateral, projecting, their distance from end of snout one-half that from the eye. Canthus rostralis relatively prominent, its outline convex in front of the eye, concave behind the nostril; loreal region correspondingly more convex than concave. Eye large and prominent, its diameter two-thirds its distance from end of snout; interorbital diameter relatively broad, slightly greater than width of the narrow upper eyelid, 1½ times the distance between nostrils. Tympanum very distinct, two-thirds the diameter of eye, separated from eye by a distance equal to about two-thirds its own diameter. Fingers very long, webbed only at the base, fourth much longer than second, reaching to disk of third which covers about one-half the tympanic area; a well-developed tubercle at base of first finger and a very prominent palmar tubercle; subarticular tubercles also extremely distinct and prominent; toes three-fourths webbed, fifth much longer than third but not reaching to disk of fourth, which covers about one-half the tympanic area; a distinct inner metatarsal and an equally prominent though smaller outer metatarsal tubercle; a very prominent serrated tarsal ridge composed of six or seven glandular swellings, and paralleled by a row of smaller pustules or tubercles which continues on the outer border of the tarsus, along the outer side of the foot and onto the fifth toe; no dermal appendage on heel. Body moderately elongate, in the postaxillary region a little narrower than the greatest diameter of the head. When hind leg is adpressed, heel reaches to between eye and nostril; when limbs are laid along the side, knee and elbow overlap; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts very finely granular, with a few scattered pustules on occiput and on sacral region; a heavy glandular ridge around upper border of tympanum; skin of throat and chest smooth, of belly and lower femur heavily granular; a very strong skinfold across the chest. A pair of external vocal sacs.

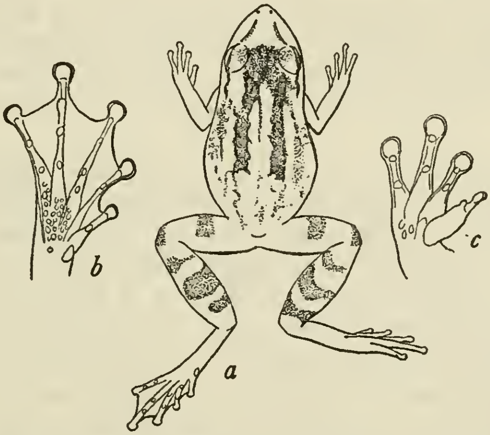


FIGURE 15.—*Hyla crospedospila*, AMNH 17025: *a*, Dorsum × 1; *b*, foot × 2; *c*, hand × 2.

Dimensions.—Head and body 29 mm.; head length 10.5 mm., width 9.5 mm.; femur 12.5 mm.; tibia 15.5 mm.; foot 12.5 mm.; hand 9 mm.

Color in alcohol.—Ground color of upper parts drab; an elongate, triangular, vandyke-brown mark between the eyes, and three or four series of irregularly paired spots down the middle of the back, with a particularly dark though small pair of spots at the termination of the body just above the anus; an irregular seal-brown line beginning on the canthus, widening behind the tympanum and extending to the groin, with short series of brown dots or lines appearing to bifurcate from it behind the shoulders; other scattered brown dots in short series or singly all over the dorsal region between the large paired brown spots; a dark brown longitudinal stripe on anterior part of upper arm; forearm indistinctly crossbanded with brown bars; femur with a wide brown longitudinal stripe on its anterior surface; its upper part light, its posterior part heavily mottled with irregular, large, vandyke-brown spots edged with dark dots; tibia with three indistinct wide crossbands edged with dark dots; tarsus with some dark longitudinal markings, bringing into relief the row of light pustules and the light tarsal ridge; anus with a brown triangular patch below it; ventral surfaces pale cream color except belly, which is dark drab.

A colored sketch by Sandig of a Campo Bello specimen, USNM 96926, shows the following colors: Dorsum drab, lighter towards anal region and on limbs; a black line along canthus rostralis; a large sepia shield-shaped interorbital spot edged with a line of black dots; a series of three elongate sepia spots edged with black dots along upper dorsolateral region; a wide pale stripe with a few dark dots down its center covering the dorsolateral area; below this a dark stripe from the tympanum fading out halfway down the sides; posterior distal half of femur and upper tibia suffused with vinaceous-cinnamon; a few indistinct olive spots on upper femur, not extending onto its posterior surface, which in this individual appears immaculate; tibia with three wide drab crossbars dotted with black and with a dotted outline; outer surface of tarsus with light drab crossbars; upper arm pale anteriorly and posteriorly, but with a dark sepia suffusion on its upper surface; forearm weakly crossbanded with drab like tarsus. Iris apparently light drab gray.

Remarks.—The comparison of cotypes of *H. fuscomarginata*, *H. crospedospila*, and *H. cuspidata* with one another and with fresh material leads to the conclusion that these three forms are closely related. All three show the characteristic narrow upper eyelids shielding the prominent eyeballs, a very wide interorbital space and a similar reduction of web between the fingers.

Specimens examined

BRAZIL:

Districto Federal: Manguinhos, USNM 96137, A. Lutz, 1932. Swamp at Km. 40, near Rio de Janeiro, on road to São Paulo, USNM 97570–1, A. Lutz, Cochran, and Venancio, Feb. 20, 1935; USNM 107304–8, Venancio and Pasarelli, December 1937. Tijuca, USNM 96238–9, A. Lutz, 1927.

Rio de Janeiro: ZSBS (16), A. Lutz, 1932. Montserrat, near Campo Bello, Itatiaia, USNM 96926–32, 96934 (cotypes of *H. crospedospila*), A. Lutz, 1923–4.

São Paulo: Juquiá, 8 km. north of, MZUM 104142 (18), 104191 (5), Bailey, 1941. Mogi das Cruzes, USNM 118991, B. Lutz, March 1944. Terceira Repressa, ZSBS (1), Schindler, Dec. 26–31, 1937.

Hyla cuspidata A. Lutz

Plate 11, Figures g, h

1925. *Hyla cuspidata* A. Lutz, 1925b, p. 211 (type locality, Rio de Janeiro); 1926a, pp. 6, 13.—Mertens, 1928, p. 298; 1950, p. 183, fig. 6.—Barbour and Loveridge, 1929, p. 278.—Myers, 1946, pp. 12, 29.

Description.—Male, USNM 87612, Recreio dos Bandeirantes, Districto Federal. Vomerine teeth in two long, heavy, transverse, narrowly separated groups between the posterior borders of the choanae; tongue two-thirds as wide as mouth opening, rounded, notched, and nearly entirely attached behind; snout somewhat elongate and angular, pointed when viewed from above, also bluntly pointed in profile and steeply declivous, the upper jaw projecting greatly beyond the lower; nostrils superolateral, projecting, their distance from end of snout about half that from anterior border of eye, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis not defined, loreal region sloping and slightly concave. Eye large, prominent, its diameter equal to its distance from the nostril; interorbital diameter about 1⅔ the width of upper eyelid which is relatively very narrow, almost twice as great as distance between nostrils. Tympanum very distinct, about two-fifths the diameter of the eye, separated from eye by an interval not quite equal to its own diameter. Fingers webbed only at the base, fourth much longer than second but not nearly reaching disk of third, which covers about one-half the tympanic area; a well-developed tubercle at base of first finger, and a flat, semidivided palmar tubercle; subarticular tubercles very well developed; toes three-fourths webbed, fifth slightly longer than third, disk of fourth covering about one-half tympanic area; a distinct projecting inner and a smaller outer metatarsal tubercle; no tarsal ridge; no dermal appendage on heel. Body not elongate, in the postaxiallary region slightly narrower than the greatest diameter of head. When hind leg is adpressed, heel reaches nostril; when limbs are laid along the sides, knee and elbow overlap considerably; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts smooth; a very indistinct glandular ridge above tympanum; skin of throat and chest smooth, of belly coarsely granular, of lower femur less coarsely granular. A distinct skinfold in front of the arm insertion on the sides of the chest. A pair of lateral external vocal sacs.

Dimensions.—Head and body 27 mm.; head length 9.5 mm., width 9 mm.; femur 12.5 mm.; tibia 15.5 mm.; foot 11.5 mm.; hand 8 mm.

Color in alcohol.—Ground color of upper parts pale tawny-olive to drab; a narrow sepia line beginning on the snout, continuing along the canthal region, over the tympanum and beyond the shoulder, the area between this and the more dorsal dark line cream-buff; the tympanum and adjoining skin of shoulder and upper arm also cream-buff; femur with indistinct dark spots anteriorly, irregularly suffused with dark posteriorly; tarsus and feet without definite color markings; ventral surface immaculate olive-buff.

Color in life.—From a painting by Sandig of a young frog, USNM 96138, taken from bromeliads at Manguinhos in April 1925. Dorsal ground color bright tawny-olive with a yellowish tinge on the limbs; a sepia stripe along canthus rostralis; a sepia crossbar between the eyes, the dark area just behind it fading gradually into the dorsal tone; a dark lateral stripe bordered above by a wide light dorsolateral stripe of the ground color, which in turn is bordered above by a longitudinal series of elongate sepia spots set off by minute lemon-yellow dots. Upper part of femur with indistinct wide drab spots; posterior surface of femur drab; upper surface of tibia and forearm with wide drab crossbars, feet and hands with faint darker mottlings, webs and disks white. Ventral surface immaculate pearl gray, the belly slightly suffused with pinkish and the lower limb surfaces with olive. Iris orange-rufous, the black pupil transversely elliptic.

Variations.—The examples of this form collected near the city of Rio de Janeiro show no great structural variation, but the dorsolateral dark spots are a little more completely fused into a more or less continuous broad dark stripe, with a rather conspicuous wide light stripe followed by the dark lateral stripe below it, while the triangular interorbital patch is seldom complete but is represented by three dark spots, one for each angle of the triangle. Occasionally a very pale individual like the one described is found with only a dark line along canthus and above ear, although most specimens are heavily patterned. The sharp-pointed broad head and the extremely narrow eyelids shielding prominent eyes make it possible to recognize the frog without the distinctive color pattern.

Remarks.—Dr. A. Lutz noted that frogs of this species were formerly found on bromeliads in mango trees near the Instituto Butantan. The bromeliads have been removed, and the frog has not reappeared. The eggs have not been found. The call of this frog may be imitated by making a sucking, clucking noise with the tongue, many times repeated.

Specimens examined

BRAZIL:

Districto Federal: Baixada Fluminense, MZUM 104135 (4), Bailey 1941. Manguinhos, USNM 96139, A. Lutz, April 1925; USNM 96147–9, A. Lutz, June 23, 1922. Recreio dos Bandeirantes, USNM 97612, 97617–8, Cochran, B. Lutz, and Venancio, 1935. Pico de Tijuca, MZUM 104136 (10), 104150, Bailey, 1941.

Rio de Janeiro: AMNH 25237, A. Lutz, 1927. Estrella, USNM 96443–6, A. Lutz, March 1929.

Hyla fuscomarginata A. Lutz

Plate 11, Figures i–k

1925. *Hyla fuscomarginata* A. Lutz, 1925a, p. 138 (type localities, São Paulo and Bello Horizonte); 1926a, pp. 6, 13.—Myers, 1946, pp. 12, 29.

Description.—Adult male, USNM 96964 (cotype), Bello Horizonte, Minas Gerais. Vomerine teeth in two weakly developed, short, narrowly separated, transverse series between the posterior borders of the choanae; tongue three-fourths as wide as mouth-opening, broadly cordiform, distinctly notched on its free posterior margin; snout moderately long, bluntly pointed when viewed from above, rounded in profile and declivous; upper jaw projecting considerably beyond the lower; nostrils superolateral, projecting, their distance from end of snout slightly less than one-half that from eye, separated from each other by an interval equal to about three-fourths their distance from eye. Canthus rostralis not distinct; loreal region flat. Eye moderate in size, not especially prominent, its diameter equal to its distance from nostril; interorbital diameter 1½ times the width of upper eyelid which is relatively narrow, 1½ times the distance between nostrils. Tympanum not very distinct, about one-third diameter of eye, separated from eye by an interval equal to its own diameter. Fingers very slightly webbed at the base, fourth considerably longer than second; disk of third appears to cover about one-half the tympanic area; no rudiment of pollex visible; toes one-half webbed, third and fifth subequal, disk of fourth covering about one-half the tympanic area; a distinct inner but no outer metatarsal tubercle; no tarsal ridge; no dermal appendage on heel. Body distinctly elongate, in the postaxillary region somewhat narrower than greatest diameter of head. When hind leg is adpressed, heel reaches nostril; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to the body, heels greatly overlap. Skin of upper parts slightly granular; no apparent glandular ridge above tympanic area; skin of throat and chest smooth, of belly and anal region coarsely granular, of distal lower surface of femur smooth; apparently a slight skinfold across the chest. A prominent external (median?) vocal sac.

Dimensions.—Head and body 24 mm.; head length 8 mm., width 7.5 mm.; femur 11 mm.; tibia 13 mm.; foot 9 mm.; hand 6 mm.

Color in alcohol.—Although the specimen described is deteriorated and softened by the effects of a glycerin preservative, it is still possible to make out the elements of the original color pattern. Ground color of upper parts russet anteriorly to drab posteriorly; a sepia median stripe beginning at the tip of the snout and continuing to the vent; a narrow dark crossbar between the eyes, forming a cross with the median sepia stripe; a sepia stripe along the canthus, continuing above the ear and fading out before it reaches the groin; between this stripe and the median dorsal one is a wide but less well-defined stripe from the posterior corner of the eye backwards to the vent; anterior surfaces of forearm and foreleg pale ecru-drab; a few small sepia dots on forearm, with a heavier aggregation of dots from outer part of elbow almost to wrist; a few pale brown diagonal crossbands on upper part of tibia, and several other diagonal bars, slightly darker, on tibia; tarsus and foot vermiculated with brown; ventral surfaces immaculate pale olive-buff.

Color in life.—From a painting by Sandig of a male, USNM 96964. Dorsal ground color wood brown, lighter on the limbs; a dark olive lateral stripe with a light stripe above it and another wide olive stripe above that extending from posterior corner of eye to groin; a narrow drab interorbital crossbar, and an equally narrow drab dorsal line beginning on the snout, intersecting the interorbital bar to form a cross and continuing onto the sacrum, where it widens and fades out; femur with very slight indications of dark spots; tibia and forearm with large cinnamon crossbars; outer part of tarsus also spotted with cinnamon; entire upper parts minutely dotted with pale brown; chin canary yellow, belly cream color, lower surfaces of limbs lilac gray, the webs and disks of hands and feet nearly white. Iris apparently straw yellow, the black pupil transversely elliptic.

A painting by Pugas of USNM 97613 shows the living coloration to be as follows: Dorsal ground color bice green on head and back to light bottle green on limbs; a clove-brown interorbital mark with irregular posterior prolongations; a white dorsolateral stripe beginning behind the eye, bordered above and below by wide, dark-edged, sepia stripes rather irregular in width; a sepia stripe along the canthus rostralis; several small sepia spots in the middle and posterior part of back; several pale green, narrow, longitudinal marks in the middle of the white dorsolateral stripe; femur with a white reticulated pattern around dark green spots and crossbars; anterior part of femur and knee dull sepia; tibia and forearm with wide, dark-edged green crossbars, feet and fingers with fainter spots or bars, the webs and disks very pale. Iris pinkish buff, the black pupil transversely elliptic.

Remarks.—The shape of the head and especially the sharply tipped snout of this species is imitated by *H. werneri.* It may therefore be considered as more or less intermediate between groups 4 and 5. An outer metatarsal tubercle is sometimes apparent. In the cotype described none can be discerned.

Specimens examined

BRAZIL:

Districto Federal: Amorim, USNM 96211–3, 1926. Baixada Fluminense, MZUM 104125 (3), Bailey, 1941. Jacarépaguá, USNM 96387, A. Lutz, 1921. Recreio dos Bandeirantes, USNM 97613–5, B. Lutz, Cochran and Venancio, Feb. 9–16, 1935. Rio de Janeiro, USNM 96360–3, A. Lutz, 1923.

Minas Gerais: Bello Horizonte, USNM 96964 (cotype of *H. fuscomarginata*), A. Lutz, 1924.

Rio de Janeiro: Angra dos Reis, USNM 96482, A. Lutz, 1924. Barro Branco, MZUM 104153, Bailey, 1941.

São Paulo: Alto da Serra, MP 851. Campo Grande, MP 101 (3). Raiz da Serra, MP 505. Ribeirão Pires, MP 585 (part).

Hyla fuscovaria A. Lutz

Plate 12, Figures a, b

1925. *Hyla fuscovaria* A. Lutz, 1925b, p. 212 (type locality, Agua Branca, [=Agua Limpa], Minas Gerais); 1926a, pp. 7, 13.—Mertens, 1950, p. 174.

Description.—Adult male, USNM 96988, Agua Limpa, Minas Gerais. Vomerine teeth in two very heavy, long, transverse, narrowly separated series between the choanae; tongue slightly more than three-quarters as wide as mouth-opening, broadly cordiform, its posterior margin free and slightly notched; snout rather long, rounded at the tip when viewed from above and in profile, the upper jaw projecting well beyond the lower; nostrils superolateral, somewhat projecting, their distance from end of snout about half that to eye, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis well defined; loreal region concave and sloping. Eye large, prominent, its diameter equal to its distance from nostril; interorbital diameter equal to width of upper eyelid which is relatively wide, slightly greater than distance between nostrils. Tympanum very distinct, about two-thirds the diameter of eye, separated from eye by an interval equal to half its own diameter. Fingers without any trace of web between the three outermost and with only a rudiment of a web between first and second; fourth finger a little longer than second and reaching to disk of third, which covers about one-fourth the tympanic area; no rudiment of a pollex; toes slightly more than one-half webbed, fifth slightly longer than third, disk of fourth covering one-fourth the tympanic area; a distinct inner and a small, blunt but less distinct outer metatarsal tubercle; a very fine glandular line along inner side of tarsus, not enlarged to a ridge or fold; no dermal appendage on heel. Body stout, in postaxillary region equal to greatest width of head. When hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts faintly granular or pustular; a distinct glandular ridge encircling upper part of tympanum; skin of throat very finely granular, of chest and belly more coarsely granular, of lower femur minutely granular; a prominent skinfold across the chest. A pair of external vocal sacs.

Dimensions.—Head and body 42.5 mm.; head length 13.5 mm., width 12.5 mm.; femur 19 mm.; tibia 22 mm.; foot 17.5 mm.; hand 10.5 mm.

Color in alcohol.—Ground color of upper parts fawn color, with a darker mottling of anastomosing spots over head and body; arms and legs with definite dark crossbars; groin and anterior and posterior surface of femur with pale olive and dark sepia reticulations; loreal region with irregular dark spots; upper lip with an indistinct darker border; entire lower surfaces immaculate deep olive-buff.

Color in life.—From a sketch by Sandig of one of the cotypes: Dorsal ground color drab, with indistinct mottlings of sepia all over back, becoming darker on head and suggesting a dark interorbital bar or triangle; groin and proximal half of femur canary yellow, with heavy, black, more or less vertical reticulations; outer anterior half of femur with more regular dark brown crossbars; forearm and tibia with less prominent brown crossbars; inner surface of tarsus pale gamboge, outer surface drab with numerous brown bars extending onto the two outermost digits; the disks of toes and fingers above dark at the base; ventral surface pearl gray with vinaceous suffusions on throat and under part of limbs; a suffusion of canary yellow on under surface of tibia, on anterior part of femur and below groin, these containing the terminations of the brown reticular markings. Iris wax yellow, pupil black.

Variations.—The numerous examples of this common form show the same extreme degree of variation in pattern that is met with in its southern relatives, *H. hayii* and *H. nasica*, and their bodily proportions are quite close to those of *nasica*. The described specimen has an interorbital width equal to 1½ times the upper eyelid, while younger specimens have it almost twice the upper eyelid. The fingers in the type and several of the Lassance specimens appear to be completely devoid of a web. In other examples there is a slight rudiment of a web, not so extensive in any specimen of *fuscovaria*, however, as in *nasica* from Santa Catarina.

Remarks.—*H. fuscovaria* seems to be exceedingly close to *H. nasica* from Misiones, Argentina. No structural differences are apparent, and the proportions of head, tibia, and foot compared to body length are almost identical. The size of the southern form appears to be a little greater, up to 49 mm. for some of the female *nasica* from Misiones, and 44 mm. for the largest adult female from Lassance. The dorsal pattern in *fuscovaria* seems to be on the whole less clear cut than is the case with specimens of *nasica*; there is often very little, if any, separation between the dull mottling of the back and the interorbital region in *fuscovaria*, while these areas in *nasica* usually show the dark interorbital bar or triangle, followed by one or two W- or Λ-shaped, large dark markings. The leg pattern is finer in *fuscovaria*, so that the marbling of yellow and black on the posterior femur gives a finely and rather evenly checkered or spotted appearance instead of the coarse irregular blotches of light surrounded by dark usually found in *nasica*.

H. fuscomarginata, which is likewise found in Minas Gerais, is much like *fuscovaria* in general appearance, but it is smaller, its snout is more pointed and its eyes are much farther apart and have narrower lids. There is, in addition, a narrow dark canthal stripe continued back above the tympanum in *fuscomarginata* which is not usually present in *fuscovaria*.

Specimens examined

BRAZIL:

Bahia: Bahia, MP 182 (2) and 332. Bom Jardim, USNM 98819–21, Dias, Apr. 13, 1935.

Minas Gerais: Agua Limpa, near Ouro Preto, USNM 96988 (cotype of *H. fuscovaria*), A. Lutz, 1922; USNM 96992–4 (cotypes of *H. fuscovaria*), A. Lutz, Oct. 22, 1921. Bello Horizonte, USNM 96975–7, Aroeira. Januária, USNM 98814, Dias, Apr. 11, 1935. Lagôa Santa, on road to Bello Horizonte, USNM 97982, Mar. 14, 1935, Cochran. Lassance, USNM 97001–5, A. Lutz, Mar. 1, 1922; USNM 98090–125, Cochran, Dias, and Venancio, Mar. 22–26, 1935. Pirapora, USNM 98247–50, Cochran and Venancio, Mar. 22–23, 1935. Piraporinha, USNM 98539–47, Cochran, Dias, and Venancio, Mar. 23, 1935. Ponte Nova, USNM 96911, A. Lutz, Dec. 14, 1933.

Hyla hayii Barbour

Plate 12, Figures e–i

1909. *Hyla hayii* Barbour, p. 51, pl. 5 (lower figure) (type locality, Petrópolis, Rio de Janeiro).—Nieden, 1923, p. 287.—Miranda-Ribeiro, 1926, p. 71.—Barbour and Loveridge, 1929, p. 278.—Estable, 1942, p. 53.

Description.—Adult male, USNM 97776, Alto da Serra, São Paulo. Vomerine teeth in two very heavy, short, transverse groups close together on a level with the posterior borders of the choanae; tongue about four-fifths as wide as mouth-opening, almost circular except for a slight notch on its free posterior border; snout large, rounded when viewed from above and in profile, the upper jaw extending somewhat beyond the lower; nostrils superior, projecting, their distance from end of snout about half that to eye, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis not defined; loreal region flat and very oblique. Eye large, prominent, its diameter equal to its distance from nostril; interorbital diameter about 1⅓ times the width of upper eyelid, greater than distance between nostrils. Tympanum distinct, about two-thirds the width of eye, separated from eye by an interval almost equal to its own diameter. Fingers distinctly webbed at their base, fourth slightly longer than second, but not reaching to disk of third which covers one-half the tympanic area; no rudiment of a pollex visible; toes three-fourths webbed, fifth very slightly longer than third, disk of fourth toe covering a little less than half the tympanic area; a distinct oval inner and a smaller but distinct, rounded outer metatarsal tubercle; a faint suggestion of a glandular ridge along inner side of tarsus; no dermal appendage on heel. Body heavy and broad, in postaxillary region equal to greatest width of head. When hind leg is adpressed, heel reaches to nostril; when limbs are laid along the side, knee and elbow just touch; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts glandular with a finely pustular appearance especially on the lumbar region; a pronounced glandular ridge encircling upper part of tympanum and ending above the shoulder; skin of throat and chest very finely pustular, that of belly coarsely granular, that of lower proximal femur very finely granular, the rest of the femur and tibia quite smooth below; a skinfold across the chest. A pair of external lateral vocal sacs.

Dimensions.—Head and body 39 mm.; head length 14 mm., width 14 mm.; femur 17 mm.; tibia 20 mm.; foot 16 mm.; hand 11 mm.

Color in alcohol.—Ground color of upper parts smoke gray, becoming pale drab on the limbs; an indistinct triangular mark composed of slate-black dots between the eyes; a narrow irregular slate-black line along canthus rostralis and another series of dark dots in linear arrangement along upper lip; several irregular spots with dark dotted outlines on the back; an aggregation of dark dots on elbow and another around wrist; posterior part of femur with a wide seal-brown stripe enclosing numerous small round pale yellowish spots; some wide, very indistinct slate crossbars on tibia and faint ones on tarsus and foot; one or two irregular large buff spots in the groin, surrounded by a slate border which merges gradually with the pale olive-gray of the sides; entire ventral surface olive-buff, with minute gray dots around edge of lower jaw, on belly, and on lower surfaces of limbs.

Color in life.—One of the Alto da Serra series was described a few days after being collected, as follows: Above, chromium to pea green, with indistinct sepia spots. Hind legs crossbarred indistinctly with dark, the light spots on posterior thighs being olive yellow. Lower surfaces pale primrose yellow. The females are a deep clove brown above, on which the citron-yellow spots on posterior thighs stand out strongly. There are also citron-yellow spots in groin, halfway on sides of axilla, and on anterior side of thighs.

Variations.—The largest of the Alto da Serra specimens is a female, USNM 97780, measuring 49 mm. in head and body length. Its entire dorsal ground color is clove brown, with a few scattered, very minute white dots on head, back, and tibia. The primrose yellow spots in the groin and on the fore and hind parts of the femur show up with great brilliance against the contrasting dark ground color. The whole ventral surface is covered by small dark dots, the only immaculate area being that in the depths of the very conspicuous skinfold across the chest. The soles of the hands and feet are a uniform dull slate in this individual. A young male, USNM 97779, has a similar dark, clove-brown coloring on the head and back, but the upper parts of the femur and the foot are drab-gray. It is also less closely dotted on the lower surfaces. The other specimens, all apparently males, from Alto da Serra, range from slate-gray to olive-gray above, with yellow spots consequently much less prominent. The largest of these, USNM 97784, measures 42 mm. in head and body.

The entire series of *H. hayii* from the State of São Paulo shows an extreme amount of variation in almost every character. The snout is rounded in a few examples, but slightly or moderately pointed in most, while it is very pointed and rather elongate from the nostrils forward in some. The interorbital space is relatively narrow (1¼ times the width of the upper eyelid) in many, but relatively wide (1⅔ times the eyelid) in some examples. The tympanum varies equally, being extremely large (three-fourths to four-fifths the diameter of the eye) in some, and smaller (one-half or two-thirds the eye diameter) in others. The fingers in about half the specimens have distinct rudiments of a web at the base, while the remainder of the frogs show only slight traces and in a few cases scarcely any of the rudiments of a web. The disk of the fourth toe in well-preserved specimens usually covers about one-half the tympanum, but sometimes when the tympanum is large and the disk is not well developed, it covers only one-third the tympanic area, and in one example where the tympanum is quite small, the disk covers it completely. The adpressed heel reaches to anterior border of eye, to between eye and nostril, and to the nostril in about an equal number of cases; rarely, it extends beyond the tip of the snout.

The pattern is as variable as the bodily proportions. In some there is no dorsal pattern at all, the back being a uniform pale gray (greenish in life) or darker brown. There is often a dark interorbital bar, which in many cases is enlarged to a distinct triangle. Behind this above the shoulders there is usually a dark W, a Λ, or a)(, sometimes followed by other smaller spots, with quite often a dark transverse Λ or V at the sacrum, or any combination of these markings may occur. There are not, however, the long, relatively straight dark and light dorsolateral stripes which evidently characterize specimens of the typical *H. rubra* from the Guianas.

The tibia, when patterned at all, usually has three fairly wide, dark crossbands, although sometimes these are more numerous and narrower. The femur is nearly always crossbanded on top, while on its posterior surface it possesses heavy, dark reticulations on a light ground, with these light areas often formed into fairly regular circular spots, or sometimes an irregular ellipse extending halfway down the femur. Its anterior surface is a little less heavily reticulated with dark, while the groin and the posterior lateral region often have a large light spot with more or less irregular dark borders, or this whole area may be reticulated with dark over the light ground.

Remarks.—The voice is a raucous *kraw, kraw, kraw* like that of *H. rubra*. Eggs were laid in the laboratory by captive specimens, but were not allowed to develop. No tadpoles are definitely known up to the present time. The adults live in holes high in bamboos and trees, and frequently in bromeliads.

Specimens examined

BRAZIL:

Districto Federal: Bom Successo, USNM 96200–2, A. Lutz, January 1923. Recreio dos Bandeirantes, USNM 96389, B. Lutz, March 15, 1931; USNM 97611, Campos, February 18–23, 1935.

Minas Gerais: Rio Pandeiro, USNM 121365–8, Instituto Butantan.

Rio de Janiero: Angra dos Reis, USNM 70517, Metcalf, 1925. Barro Branco, MZUM 104148 (2), Bailey, 1941. Bonito, Serra da Bocaina, USNM 96712–8, A. Lutz, Jan. 19, 1930. Campo Bello, ZSBS (3), A. Lutz, 1923. Fazenda Baroneza on the Rio Muriahé, USNM 97214, 1922. Independencia, near Petrópolis, USNM 96419–21, A. Lutz, 1926.

Rio Grande do Sul: Pôrto Alegre, USNM 97182, Gliesch, Feb. 5, 1922.

Santa Catarina: São Bento, USNM 97162–3, Nahderer, April 1923; USNM 97171, Behr, 1923.

São Paulo: IB 229. Alto da Serra, USNM 96795–7, A. Lutz, February 1921; USNM 96801–4, A. Lutz, February 27, 1922; USNM 97776–88, Cochran and Venancio, April 25–26, 1935; MP 849. Boracea, MHNP 50-251 (2), Bokermann, November 1948. Butantan, USNM 121360–1, Instituto Butantan. Campinas, USNM 123900–1, Sawaya. Campo de Aviação, near São Paulo, USNM 96864–8, A. Lutz, February 9, 1924. Campo do Jordão, MP 395.

Campo Grande, USNM 102294–6; MP 226. Cantareira, MP 327. Franca, MP 302. Pindamonhangaba, USNM 96905–8, A. Lutz, 1921. Piquete, MP 265. Piracicaba, MP 287. Pôrto Martins, MP 252. Ribeirão Pires, ZSBS (2), Bresslau, June 1913. São Bernardo, USNM 102286. São Paulo, MP 588; USNM 102287–8; USNM 96858, Vellard, 1925; USNM 121075–6, P. Sawaya. Serra de Cubatão, ZSBS 59/1947 (2), A. Lutz, 1928.

Hyla parkeri Gaige

PLATE 12, FIGURES C, D

1929. *Hyla parkeri* GAIGE, p. 1 (type locality, Buena Vista, Dept. Santa Cruz, Boliva).

Description.—Adult male, USNM 98128, Lagôa do Curralinho, near Lassance, Minas Gerais. Vomerine teeth in two short, heavy, well-separated, posteriorly converging patches between posterior borders of choanae; tongue almost two-thirds the width of mouth-opening, cordiform and with a distinct notch on its partly free posterior margin; snout elongate, pointed when seen from above and in profile, the upper jaw projecting considerably beyond the lower; nostrils superior, slightly projecting, situated almost at the end of the snout, their distance from it less than one-third that to eye, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis long, rounded; loreal region concave, sloping outwards. Eye moderately large, fairly prominent, its diameter almost as great as its distance from end of snout; interorbital diameter about 1¼ times that of moderately wide upper eyelid, about 1½ times the distance between nostrils. Tympanum very distinct, about one-half the diameter of eye, separated from eye by an interval equal to less than one-half its own diameter. Fingers webbed only at the base, fourth longer than second but not reaching to base of disk of third, which covers about one-half the tympanic area; no rudiment of a projecting pollex; toes a little more than one-half webbed, fifth much longer than third, disk of fourth covering about one-half the tympanic area; a small inner and a very minute outer metatarsal tubercle; apparently no tarsal ridges; no dermal appendage on heel. Body elongate, in the postaxillary region a little less than greatest width of head; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts quite smooth; a glandular ridge encircling upper part of tympanum and ending on shoulder; skin of chin, throat, and chest smooth, that of belly and posterior femur coarsely granular; a pronounced skinfold across the chest. A very large median vocal sac.

Dimensions.—Head and body 22.5 mm.; head length 7 mm., width 6 mm.; femur 9 mm.; tibia 11 mm.; foot 8.5 mm.; hand 5.5 mm.

Color in alcohol.—Center of dorsal region pale wood brown, lightening on limbs; a pale sepia crossbar between the eyes, intersected by a faint median dorsal stripe which in this specimen becomes almost invisible on the body; a wide drab lateral stripe, its upper and lower borders emphasized with an indistinct sepia line; a narrow dark line along canthus rostralis; a faint powdering of dark dots on upper femur and tibia, tending to form indistinct crossbands on the tibia; ventral surface immaculate olive-buff; upper lip white.

Variations.—The other specimen taken at Lassance with the described specimen is a male also, and is practically identical with it except that it is 1 mm. longer and has a slightly wider head, while the crossbar between the eyes is lacking.

Four paratypes of *H. parkeri*, now USNM 84359–60 and USNM 101440–1, agree entirely with the Lassance specimens in every essential. A male, 84360, has the adpressed hind leg reaching only to posterior border of eye; the others have it reaching to center or anterior border. The largest specimen, a female, 84359, has a total length of 26 mm. Two specimens show a distinct cruciform mark on top of the head, where the interorbital bar intersects the median dark line, here thickened and relatively prominent. The others scarcely show an indication of an interorbital bar, and the median dark line is greatly reduced or almost invisible. The wide, dark, lateral stripes are constantly present in all examples. The variation seems to be very slight even from two widely separated localities, and it appears that *parkeri* is one of the more stable species.

Remarks.—A series of young frogs of this species was taken on low plants growing near a ditch beside a road at Pirapora, about 50 miles north of Lassance. The smallest of these measured 12 mm., but already the tail was completely absorbed. The recent change from tadpole to frog is attested in all these examples by the presence of the dark elongate patch showing through the skin on either side of the sacrum. The coloration at this stage is just the same as in the adult forms at hand, except for the fact that the lateral stripes are not quite so dark.

The relationship of this species to the interesting *H. squalirostris* has been discussed under the latter species. It may be that other allies of the very confused *rubra* group can be separated off as species with fairly definite geographical boundaries when more collecting has been consistently done over critical territory in northern Brazil and the Guianas.

Specimens examined

BRAZIL:

Minas Gerais: Lagôa do Curralhino, near Lassance, USNM 98128–9, Cochran, Dias, and Venancio, Mar. 21, 1935. Pirapora, USNM 98251–8, Cochran, Dias, and Venancio, Mar. 22, 1935.

São Paulo: Alto da Serra, USNM 102299. Pinheiros, USNM 97208–11, Fischer. Raiz da Serra, MP 505. Ribeirão Pires, USNM 102298. São Paulo, USNM 102300.

BOLIVIA: Buena Vista, USNM 84359–60, 101440–1, and MZUM 67461 (23) (paratypes of *H. parkeri*), Steinbach.

***Hyla perpusilla* Lutz and Lutz**

Figure 16

1939. *Hyla perpusilla* Lutz and Lutz, 1939a, pp. 78, 88, pl. 3, figs. 5–5d (type locality, Recreio dos Bandeirantes, city of Rio de Janeiro).—Myers, 1946, pp. 12, 30.

Description.—Adult male, USNM 97592, Recreio dos Bandeirantes, Districto Federal. Vomerine teeth in two short, heavy, transverse, well-separated series between the choanae; tongue about two-thirds

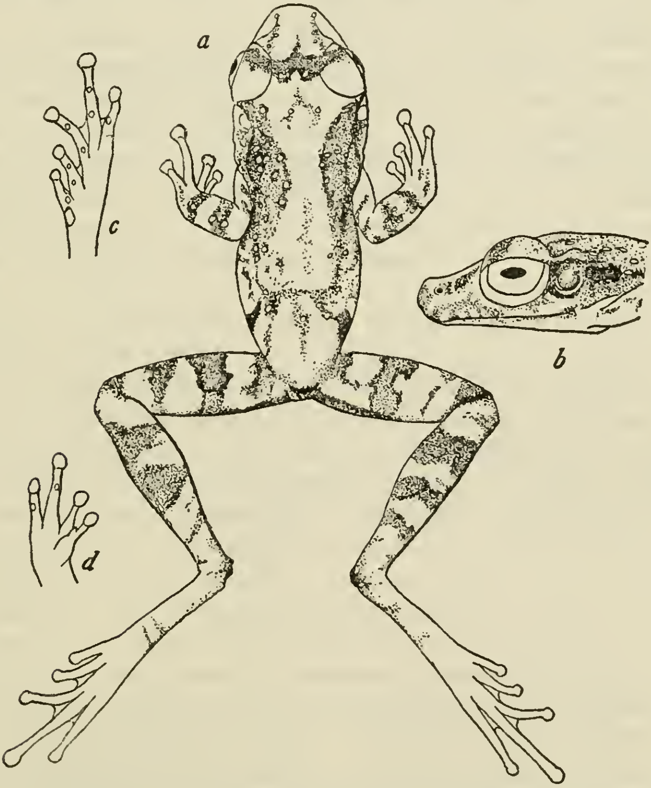


Figure 16.—*Hyla perpusilla*, USNM 97592: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × 2½.

as wide as mouth-opening, oval, its posterior margin free and slightly indented; snout large, rather bluntly rounded in profile, acutely rounded when viewed from above, the upper jaw extending considerably beyond the lower; nostrils superolateral, projecting considerably, their distance from end of snout about one-fourth that from eye, separated from each other by an interval equal to about three-fifths their distance from eye. Canthus rostralis rounded, grading into the concave, sloping loreal region. Eye large, prominent, its diameter less than its distance from end of snout; interorbital diameter about 1½ times the width of upper eyelid, much greater than distance between nostrils. Tympanum very distinct, about two-fifths the diameter of eye, separated from eye by an interval equal to its own diameter. Fingers entirely free, fourth slightly longer than second, disk of third finger covering the tympanum; no rudiment of a pollex visible; toes less than one-third webbed, fifth slightly longer than third, disk of fourth toe covering about three-fourths the tympanum; a distinct, rounded inner and a smaller outer metatarsal tubercle; a dermal fold across heel. Body slightly elongate, in postaxillary region less than greatest diameter of head; when hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts very finely glandular, with larger pustules in more or less regular series, especially prominent on head and in sacral region; a wide but indistinct glandular ridge encircling upper part of tympanum; skin of throat and chest finely granular, that of belly and lower femur more coarsely granular; a more or less apparent skinfold across the chest. A pair of lateral external vocal sacs not very strongly developed.

Dimensions.—Head and body 22.5 mm.; head length 8 mm., width 7 mm.; femur 10.5 mm.; tibia 12 mm.; foot 8.5 mm.; hand 6 mm.

Color in alcohol.—Ground color of upper parts ecru-drab; a seal-brown crossband between the eyes, anteriorly prolonged slightly on the middle of the forehead; an irregular, wide, seal-brown stripe leaving the posterior corner of the eye, widening above the shoulder, and with its upper margin bowed upwards to approach the median dorsal area; this seal-brown stripe widens and intensifies in color and ends as a postaxillary patch; a dark seal-brown diagonal spot in front of groin, its upper margins extending upwards and ending on the back; loreal region only slightly darker than rest of head, which is suffused indistinctly with pale chocolate; forearms with wide, brown crossbands, upper arms spotted with brown; hind legs with wide, prominent, brown crossbands; anterior part of femur as well as groin bleached white in alcohol; chin and throat reticulated with olive, remainder of ventral surface immaculate olive-buff except for a very pale, chevron-shaped, olive mark extending from the axilla onto the center of the chest.

Color in life.—Some color notes on a half-grown frog from Recreio dos Bandeirantes, collected on February 10, 1935, were taken from the living specimen two days after its capture. Ground color gray, with an irregular, broad band of dark color on each side extending from ocular region to near the groin. A narrow dark-edged crossband between the eyes. Arms irregularly marked with darker colors; one longitudinal spot along the anterior part of the upper arm and some larger ones on the forearm. Femur with large, rounded, partly confluent yellow spots on the upper sides, on a dark brown ground. Tibia with three large but rather indistinct crossbands. Foot gray, with darker blotches. Disks of toes and fingers dark at the base. Sides of the trunk marked in the anterior half with a dark blotch; an oblique dark band extending upon the posterior half and terminating in a point. Rest of posterior half yellowish, except for a black triangle in front of groin. Underside light, immaculate. Eye large, iris gold-bronze, pupil rhomboid, with a slight notch above and below; a prolongation of the rhomboidal pupil extended in a dark brown line horizontally. A colored sketch of this individual was made at the same time. On February 23, 1935, the frog, still alive, was compared to this painting made 11 days earlier. The color change in the frog had not been great in this interval; the back was a slightly more intense yellow ochre, otherwise it had remained as it was when first collected.

Variations.—The bodily proportions are quite constant in the 22 examples of this species from the Recreio dos Bandeirantes. Sometimes the dark interocular bar is poorly developed.

Remarks.—The specimens, USNM 118992–5, from Baixada Fluminense at Caxias are included with considerable doubt, since the probable ranges of variation in the femoral length and in the foot length do not overlap those from Recreio dos Bandeirantes. A larger series from Caxias, however, may prove that those from Recreio dos Bandeirantes are actually intergrading with the latter, and it seems unwise to base any final conclusions about the Caxias frogs on so few specimens.

Specimens examined

BRAZIL:

Districto Federal: Baixada Fluminense, at Caxias, Rio de Janeiro, USNM 118992–5, B. Lutz, November 1939. Recreio dos Bandeirantes, USNM 96388, 97587–97604, 97630–2, B. Lutz, Cochran, and Venancio, April 1935; MZUM 104134 (2), Bailey, 1941.

Rio de Janeiro: Barro Branco, MZUM 104151, Bailey, 1941.

São Paulo: Boracea, MHNP 50–252, Bokermann, November 1948.

Hyla similis Cochran

FIGURE 17; PLATE 13, FIGURES A–D

1952. *Hyla similis* COCHRAN, p. 50 (type locality, Manguinhos, Districto Federal).

Description.—The original description is reproduced here, as follows:

DESCRIPTION OF THE TYPE: An adult male, U. S. N. M. no. 97317, from Manguinhos near the city of Rio de Janeiro collected on February 25, 1935, by Joaquim Venancio. Vomerine teeth in two heavy, short, transverse groups almost continuous medially, between the posterior halves of the choanae; tongue about three-fifths as wide as mouth opening, roundly elliptical except for a deep notch on its free posterior margin; snout rather short, rounded when viewed from above and in profile, the upper jaw extending considerably beyond the lower; nostrils superolateral, greatly projecting, almost at the extreme tip of snout, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis rounded; loreal region slightly concave and very oblique. Eye large, very prominent, its diameter equal to its distance from nostril and to five-sixths the length of snout; interorbital diameter about 1¼ times the width of upper eyelid, greater than distance between nostrils. Tympanum very distinct, about two-thirds the width of eye, separated from eye by a very narrow interval equal to about one-eighth its own diameter. Fingers with a slight trace of a basal web, fourth very slightly longer than second but not reaching the base of third, which covers one-fourth the tympanic area; no rudiment of a pollex visible; toes one-half webbed, fifth slightly longer than third, disk of fourth toe covering about one-fourth the tympanic area; a distinct oval inner and a small, wartlike outer metatarsal tubercle; a faint glandular ridge along inside of tarsus and a still weaker outer tarsal ridge; no dermal appendage on heel. Body moderately heavy in build, in postaxillary region narrower than greatest width of head. When hind leg is adpressed, heel reaches to anterior border of eye; when limbs are laid along the body, knee and elbow are separated by a considerable interval; when hind legs are bent at right angles to the body, heels considerably overlap. Skin of upper parts with numerous elongate glandules and small tubercles, especially prominent on the center of the back; a narrow glandular ridge encircling upper part of tympanum and ending just behind it above the shoulder; skin of throat

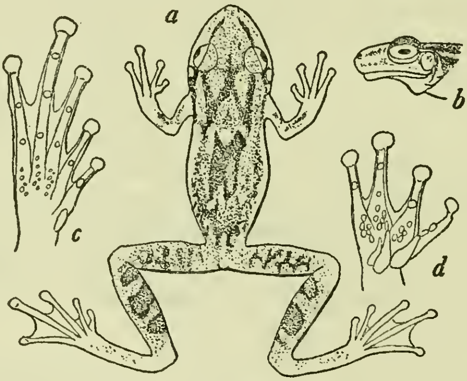


FIGURE 17.—*Hyla similis*, USNM 97317 (type): *a*, Dorsum × 1; *b*, profile × 1; *c*, foot × 2; *d*, hand × 2.

and chest with minute scattered pustules, that of belly coarsely granular on the breast, finely granular posteriorly and on the lower surface of femur; a slight skin fold across the chest and another much more prominent preceding it across the throat. A series of lateral folds on each side of the throat marking the presence of lateral gular sacs in the male.

Dimensions: Head and body, 35 mm; head length, 11.5 mm; diameter of eye, 4 mm; width of head, 11 mm; femur, 15 mm; tibia, 16.5 mm; hind limb, 48 mm; forelimb, 19 mm; foot, 14 mm; hand, 9 mm.

Color in alcohol: Dorsal ground color ecru-drab, with an indistinct light sepia triangle between the eyes; a dorsolateral longitudinal series of very irregular sepia spots sometimes anastomosing across the back, their outer margin dark and fairly straight, delineating a dorsolateral stripe of the pale ground color, this light stripe edged below with an indefinite dark stripe, which begins behind the tympanum and breaks up on the sides into a fine reticulation of dark on a light ground, continued and becoming coarser toward the groin; a faint dark line along canthus rostralis; loreal region and upper lip marbled slightly with drab; upper surface of femur with fine sepia reticulations fading out on the anterior surface, becoming darker and coarser on the posterior surface and enclosing irregular pale cinnamon areas; upper surface of tibia with three large diagonal spots; outer tarsus and upper arm indistinctly marbled with drab; ventral surface immaculate buff.

Color in life: Some color notes on living specimens from Manguinhos were made on January 18, 1935. U. S. N. M. no. 97374: Malachite to sage green above, immaculate. Posterior femur chrome-yellow with brown reticulations. Throat citron-yellow; belly sulphur-yellow in the center, chrome-yellow toward the sides, immaculate. U. S. N. M. no. 97376: Dorsum clay color in center, with a drab dorsolateral stripe. Groin and ventral surface olive-buff, the sides with sepia spots. Fore and hind legs ochraceous, barred with raw umber. U. S. N. M. no. 97375: Dorsum light olive-gray, with coarse mouse-gray blotches edged with black. Upper and posterior parts of femur orange-ochraceous, mottled with dark sepia. Chin, chest, and lower parts of limbs ecru-drab; belly pale blue.

Variations: Within the usual limits there is the same amount of confusing variation in this species that is met with in the other members of the *rubra* group. The snout is usually rounded, but in about one-third of the examples it is slightly pointed. The tympanum, always distinct, may range from one-half to two-thirds the diameter of the eye in width. The interorbital diameter is often 1½ times the width of the upper eyelid, but in a few instances scarcely exceeds the eyelid in width. The distance from the posterior border of the tympanum to the tip of the snout varies between 31 and 36 percent of the total length of head and body, while the tibia is from 43 to 54 percent of this length. The adpressed heel may reach occasionally only to the posterior corner of the eye, most often to the center or anterior border of the eye, and rarely as far as the nostril. The disks of the fingers may be large, moderate or rather small, and as the tympanum itself varies considerably in size, the fourth finger disk may cover as little as one-fourth of its area to as much as two-thirds. The skin of the back is smooth in perhaps one-fourth of the specimens (this may depend on preservation to some extent), faintly granular all over in some, granular only on the posterior part in others.

The pattern seems as varied as do the physical dimensions. Usually there is a more or less distinct dark area between the eyes, but no other markings are at all constant. Some individuals are pale drab, with remnants of longitudinal dark stripes as in *rubra* appearing in this species as two rather irregular dark stripes enclosing a light area on each side of the back. In other specimens the upper one of the two dark stripes shortens and becomes crescentic; in many cases its inner edge approaches its fellow until they nearly fuse across the back, and in some cases they actually do become fused, with a few scattered light spots on them which may indicate their usual limits. Sometimes there is an irregular network of coarse dark spots down the back; sometimes an inverted V or its separated elements may appear on the sacral region. The upper part of the femur is usually irregularly spotted or reticulated; in only a few instances do these spots suggest the regular dark cross bars characterizing some other members of this group. Quite often the posterior surface of the femur reveals a rather large, very irregular, elongate light spot surrounded and set off by narrow dark reticulations. In other cases the posterior femur is finely marbled with small light and dark spots in about equal proportions. The upper surface of the tibia often has three irregular oval spots placed diagonally across it. Any of these dark spots may lighten, leaving only a narrow dark outline which suggests a parallelogram or an irregular circle. Numerous small dark dots scattered over the upper surfaces still further obscure the pattern. The sides sometimes show linear rows of dark dots more or less fused into a network, or often a scattering of fine dots with no particular arrangement. The groin quite often has a very pale (yellowish in life) area, confined sometimes to an elongate irregular spot encircled by darker, heavier reticulations. The ventral surface appears to be immaculate in the specimens at hand. A good many individuals show a dark brown stripe along the canthus, with considerable spotting on the upper lip; other specimens have a much lighter canthal stripe and the labial spots are reduced to a light marbling. Sometimes the canthal stripe is continued over the tympanum as a narrow dark line, widening behind the ear and often ending in front of the forearm, but also sometimes carried part way down the side of an irregular dark stripe.

REMARKS: It is perhaps rash to give a new name to another of the *rubra* group, the most variable of any in Brazil, but no formerly proposed name seems to be applicable to the form coming from within the Federal District. *H. x-signata* of Spix from Bahia is apparently nearest to *similis*, after *fuscovaria*, but fresh Bahian material is needed before an exact comparison can be made.

This species has the peculiar habit of "swarming," as hundreds appeared at one time on a tree outside the laboratory at the Instituto Oswaldo Cruz. The voice of the adult is a high-pitched *crack, crack, crack, crack,* sounding somewhat like that of a duck. Breeding takes place in March and April. The tadpoles metamorphose very rapidly, taking only 20 to 30 days to change into frogs, but they are rather delicate, as they die from the effects of too much sun if the water in which they live is not deep enough.

While this species is exceedingly plentiful at Manguinhos, it is not known from the southern part of the state of Rio de Janeiro. In fact, only two other examples at all resembling this form are known outside of the Manguinhos material. One of these is from Bom Successo, a few minutes' ride by automobile from Manguinhos while the other, no. 96213, not in good condition but seeming to belong to the present species, is from Amorim near the city of Rio de Janeiro.

Specimens examined

BRAZIL:

DISTRICTO FEDERAL: Amorim, USNM 96312, A. Lutz, January 1926. Bom Successo, USNM 96203, A. Lutz, Oct. 25, 1928. Manguinhos, USNM 97317 (type of *H. similis*), Venancio, Feb. 25, 1935; USNM 97312–6, 97318–52, 97374–6 (paratypes of *H. similis*), Venancio, January–May 1935; USNM 96144–6, A. Lutz, January 1922. Rio de Janeiro, USNM 81119–21, A. Lutz, 1930.

Hyla squalirostris A. Lutz

FIGURE 18

1925. *Hyla squalirostris* A. LUTZ, 1925b, p. 212 (type locality, marshes of the Serra da Bocaina [boundary of Rio de Janeiro and São Paulo]); 1926a, pp. 7, 14.

Description.—Adult male, USNM 96719 (cotype), Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two short, transverse, well-separated, heavy groups between and extending slightly behind the posterior level of the choanae; tongue two-thirds as wide as mouth-opening, very elongate, oval in shape, its posterior margin slightly free and with a trace of an indentation; snout very long and pointed when seen from above, angularly pointed in profile, the upper jaw projecting greatly beyond the lower; nostrils superior, slightly projecting, their distance from end of snout one-third that from eye, separated from each other by an interval equal to three-fifths their distance from eye. Canthus rostralis long, well-defined towards the nostrils; loreal region concave, sloping outwards. Eye relatively small, not particularly prominent, its diameter less than half its distance from end of snout; interorbital diameter twice the width of upper eyelid, which is relatively narrow, about 1½ times the distance between the nostrils. Tympanum very distinct, three-fifths the diameter of eye, separated from eye by four-fifths its own diameter. Fingers without any vestige of a web, second and fourth subequal, disk of third covering one-third the tympanic area; no rudiment of a

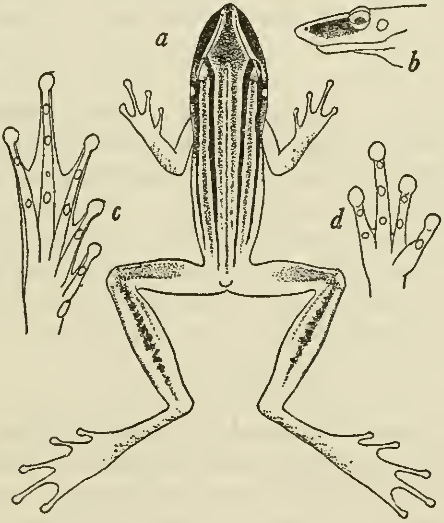


FIGURE 18.—*Hyla squalirostris*, USNM 96719: *a*, Dorsum × 1½; *b*, profile × 1½; *c*, foot × 3; *d*, hand × 3.

pollex; toes slightly less than one-half webbed, third and fifth subequal, disk of fourth toe covering one-third the tympanum; a distinct small inner and a very minute outer metatarsal tubercle; a low glandular ridge along inside of tarsus; no dermal appendage on heel. Body very elongate, in the postaxillary region considerably less than greatest diameter of head; when hind leg is adpressed, heel reaches midway between eye and nostril; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels greatly overlap. Skin of upper parts very smooth; a pronounced glandular ridge encircling upper part of tympanum and ending on shoulder; skin of chin smooth, of throat and chest very finely glandular, of belly and lower femur very coarsely granular; no apparent skinfold across the chest. A prominent external median vocal sac.

Dimensions.—Head and body 26 mm.; head length 10 mm., width 8 mm.; femur 11.5 mm.; tibia 15 mm.; foot 10.5 mm.; hand 6 mm.

Color in alcohol.—In the badly bleached and faded specimen described, the following colors nevertheless can still be distinguished: Ground color of upper parts pale wood brown; a russet stripe beginning at the nostrils, continuing along the loreal region and through the tympanum onto the sides where it fades out before reaching the groin; a wide, pale dorsolateral stripe above this, beginning behind the eyes and continuing to end of body; a wide russet stripe above this, beginning on the upper eyelids and continuing back to the sacral region; median dorsal region without markings, although the transparency of the skin allows the dorsal aorta above the backbone to be visible; entire ventral region, as well as upper and lower parts of limbs, immaculate pale wood brown.

Color in life.—From a sketch by Sandig of, presumably, USNM 96719. Top and side of head seal brown to vandyke brown, with the brown continuing as a broad stripe down the center of the back, becoming light russet before it reaches the anus, and edged with a black stripe on each side; a very narrow black median line from tip of snout to anus; a narrow white line beginning at the nostrils and running along the canthus rostralis, beginning again on the posterior part of the eyelid and continuing to the groin; another black stripe edging this white one from eye to groin on the sides; femur tawny to ochre yellow with a suffusion of flesh color, without markings except for a few dark dots near the knee; tibia also pinkish russet, with a narrow dark line along its outer border, then a stripe of the ground color, then a wide upper area of fine black dots; tarsus and forearm wood brown, slightly spotted with darker; chin chrome yellow, chest buff-pink, belly and sides sulphur yellow, lower surfaces of limbs buff-pink, the hands and feet darker, the disks of the toes and fingers light. Iris apparently light drab, the black pupil transversely elliptic.

Variations.—The heavy plaited folds of skin on the throat of the male prove the presence of a large external vocal sac. The species is apparently very stable as to bodily proportions and color pattern, for the extremely elongate snout and undershot "shark's mouth" is equally developed in the series of nine at hand, while the four dark stripes separated by lighter areas, and even the narrow median dark line, are to be seen in those which have kept their pattern at all. The heel reaches to between the tip of the snout and the eye in all examples.

Remarks.—As Mrs. Helen T. Gaige pointed out to me while examining the *H. squalirostris* specimens, *H. parkeri* Gaige is a close ally, a fact that links *squalirostris* definitely to the *rubra* group. In spite of the obvious similarities, however, the differences between *squalirostris* and *parkeri* are great and constant. Not only is the snout of *squalirostris* longer than that of the sharp-nosed *parkeri*, its tympanum and eye are much smaller in proportion to the snout length, while the toes have less webbing and the disks of fingers and toes are smaller. The size of adults is about the same in both species, and their coloration is practically identical.

Two frogs collected by Dr. B. Lutz in Teresópolis in March 1945 resemble *squalirostris* in the overhanging upper jaw and somewhat in color and body proportions, but have shorter snouts and larger eyes. *H. lindneri* Müller and Hellmich, from the Chaco region, is similar in general appearance but has significantly greater head width and femoral and tibial lengths than *squalirostris*.

According to Dr. A. Lutz, this species is entirely nocturnal and is not seen or heard before 10 o'clock. It was first heard late at night by Bertha Lutz, who remarked on a new call coming from plants in the bog near the house of the Fazenda do Bonito. Later on, it was observed often to ascend the stalks of *Juncus* growing in this place, where it would perch at the tip and sing late at night. Its voice is like the sound made by winding a watch, *cr*, *cr*, *cr*, with a trilled *r*. No eggs or young are known. The species is not common. The adult is very active in jumping and is difficult to catch because of its exceeding slenderness.

It somewhat suggests *Hyla polytaenia* Cope in its longitudinal striping of white and dark brown or black, but the two species are not at all similar in other respects.

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96719–20 (cotypes), A. Lutz, B. Lutz, and Venancio, Jan. 16–30, 1925. Serra da Bocaino, USNM 96608–13, 96721, A. Lutz; ZSBS (2), A. Lutz, 1932.

Hyla strigilata brieni de Witte

Plate 13, Figures e–g

1926. *Hyla catherinae* Miranda-Ribeiro (part), p. 80 (specimens from São Paulo), pl. 5, fig. 4.
1930. *Hyla brieni* de Witte, 1930a, p. 227, pl. 8, figs. 3, 4 (type locality, São Paulo).
1937. *Hyla catarinae* (sic) Mello-Leitão, p. 330.

Description.—Adult male, USNM 97816, Alto da Serra, São Paulo. Vomerine teeth in two short, heavy, transverse series lying close together on a level with the posterior borders of the choanae; tongue three-fourths as wide as mouth-opening, broadly cordiform, its posterior border free and deeply notched; snout large, rounded when viewed from above, truncate in profile, the upper jaw extending considerably beyond lower; nostrils more superior than lateral, considerably projecting, their distance from end of snout about one-third that from eye, separated from each other by an interval equal to about two-thirds their distance from eye. Canthus rostralis slightly defined; loreal region concave and very oblique, the upper lip flaring out strongly below it. Eye large, very prominent, its diameter equal to its distance from nostril; interorbital diameter slightly less than width of upper eyelid, which is relatively wide, slightly greater than distance between nostrils. Tympanum very distinct, about three-fifths the diameter of eye, separated from eye by a distance nearly equal to its own diameter. Fingers entirely free, fourth considerably longer than second, just reaching to disk of third which covers about two-thirds the tympanic area; no rudiment of a pollex; toes slightly more than one-half webbed, third and fifth subequal, disk of fourth covering about one-half the tympanic area; a distinct oval inner and a smaller but equally distinct rounded outer metatarsal tubercle; no tarsal ridge; no dermal appendage on heel. Body not elongate, in postaxillary region a little narrower than greatest width of head; when hind leg is adpressed, heel reaches almost to nostril; when limbs are laid along the sides, knee and elbow considerably overlap; when hind legs are bent at right angles to body, heels overlap greatly. Skin of upper parts highly glandular, with prominent, elongate, wart-like tubercles arising from various areas in which the glandules of the skin appear particularly concentrated, these tubercles particularly conspicuous on snout, including loreal and canthal regions, on upper eyelids and occiput, along the dorsolateral regions, where they occur in regular places corresponding to the color pattern, on the sacral region, and around the anus; a few less-well-developed tubercles on upper surfaces of arm and tibia; a rather narrow glandular ridge encircling upper part of tympanum; skin of throat, chest, belly, and lower femur uniformly and very finely granular; traces of a skinfold across the chest; a round, flat, poorly developed inguinal gland; vocal sac apparently internal.

Dimensions.—Head and body 36 mm.; head length 12.5 mm., width 11.5 mm.; femur 16 mm.; tibia 18 mm.; foot 14.5 mm.; hand 10 mm.

Color in alcohol.—Ground color of upper parts deep olive; a light-edged, dark, clove-brown, triangular spot between the eyes, its angles extending to the edge of the eyelids and over the occiput; a dark clove-brown loreal stripe and some dark diagonal spots on the upper lip; an irregular clove-brown stripe beginning behind the eye, widening above the shoulder, and ending in several fingerlike irregular prolongations; an irregular anastomosing pattern of sepia spots across the back; arms and legs heavily crossbanded with wide, diagonal, clove-brown bars; these continued on the anterior and posterior surface of femur, and appearing in the groin as irregular heavy blackish brown patches on a pale ground; ventral surfaces drab-gray with a fine sepia reticulation especially distinct on throat, chest, and lower femur, more suffused on belly and rest of lower limb surfaces. Concealed surfaces of legs with a pale ground which emphasizes the heavy continuations of the dark crossbands.

Variations.—In this same series from Alto da Serra, São Paulo, the dorsal coloration varies from dark seal brown through sepia to light fawn color and pale olive-gray. The dark triangular spot between the eyes is very conspicuous and most examples show the Λ-shaped sacral mark, as well as a pair of Λ-shaped dark spots between the shoulders. The back is beautifully marbled with irregular, wavy markings, which became very dark on the sides of the body. The femoral bars are lighter on top, darker as they go over the front and back femoral surfaces, usually fading out below on the pale specimens, but making a dark, suffused reticulation with yellow or orange interstices on the darker animals. The belly may be quite immaculate, or covered with coarse or fine brown reticulations. The chin is usually finely spotted with dark. The light inguinal spot (bright orange in life) is very apparent in all, being heavily margined above and below with dark brown. In color this form is closest to *H. catharinae* Boulenger, a photograph of which is shown on plate 13 for comparison.

The variation in size of the tympanum in the Alto da Serra series is very great; in most of the individuals it is about equal to half the eye diameter, but in several it is two-thirds this diameter, while a few show it but one-third the eye diameter. In USNM 96918, an adult female *H. flavoguttata* from Minas Gerais, the tympanum is noticeably small compared to an average *H. brieni*.

The inguinal gland is not evident on soft alcoholic specimens, but on those which have hardened in formalin the pulling of the surrounding skin of belly and side into little ridges makes it stand out well.

Remarks.—The type of *H. brieni* is somewhat dried up, so that the reconstructed drawing of it which accompanies deWitte's description does not give the true body shape. The head is too short in the drawing, even allowing for perspective; the distance from a line between the posterior corner of eyes to tip of snout is less than one-fifth the total head and body length in the drawing, but in the specimen itself it is more than one-quarter the total length.

This species is to be found on wooded mountain ranges, and frequents bromeliads and tree holes at night. Its voice is an interrupted, staccato series of short, sharp trills, very high in pitch, that may be imitated by whistling *pé-pé, pé-pé* into a glass vial. No eggs are known, but the larvae have been found in very cold running water, and may be taken with a dip net along with adults. The tadpoles are a beautiful golden color with markings on the tail, and have funnel-mouths to fasten onto the stones in swift currents. The adults are never found in tall trees, but sometimes may be found in arboreal ferns overhanging the water or near it.

Specimens examined

BRAZIL:

São Paulo: Alto da Serra, USNM 97790–97818, Cochran and Venancio, Apr. 25–26, 1935; MRHN IG 9404 Reg. 76 (type of *H. brieni*), Massart, Sept. 27, 1922; MP 362. Juquiá, 8 km. north of, MZUM 104166, Bailey, 1941. Piquete, BM 1901.7.29.26, Robert. Ypiranga, MP 2044.

Hyla strigilata flavoguttata **Lutz and Lutz**

Plate 14, Figures a–c

1939. *Hyla flavoguttata* Lutz and Lutz, 1939a, p. 75 (type locality, Serra da Bocaina, boundary between Rio de Janeiro and São Paulo).

Description.—Adult female, USNM 121636 (paratype), Petrópolis, Rio de Janeiro. Vomerine teeth in two small transverse, well-separated patches between the choanae; tongue about three-fourths as wide as mouth-opening, broadly oval, very slightly concave on its free posterior border; snout moderately elongate, its tip truncate when viewed from above and in profile, the upper jaw extending considerably beyond the lower; nostrils more lateral than superior, the flesh around them projecting and anteriorly forming a pair of broadly conical projections, the tip of the snout between these projections appearing concave; distance of nostrils from end of snout about one-fifth that from eye, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis pronounced; loreal region slightly concave and flaring widely to the upper jaw. Eye very large and prominent, its diameter nearly equal to its distance from tip of snout; interorbital diameter about 1¼ times that of upper eyelid, a little greater than interval between nostrils. Tympanum distinct, small, about two-fifths the diameter of eye, separated from eye by an interval equal to two-thirds its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching almost to base of disk of third, which covers the tympanum; no rudiment of a pollex; toes one-half webbed, third and fifth subequal, disk of fourth covering tympanum; a small oval inner but no outer metatarsal tubercle; subarticular tubercles well developed on fingers and toes; no tarsal ridge or dermal heel appendage. Body elongate, in postaxillary region much less than greatest width of head; when hind leg is adpressed, heel reaches to nostril; when limbs are laid along the body, knee and elbow overlap considerably; when hind legs are bent at right angles to the body, heels greatly overlap. Skin of upper parts with numerous pointed tubercles especially prominent on upper eyelids, between the eyes, and on loreal region; a single large tubercle in center of canthus rostralis and others around the tympanum; tubercles on back smaller and more widely spaced, those on sides more closely set; a few weak tubercles on forearm and tibia; throat and belly coarsely granular, edges of chin nearly smooth; granules extending into axillary region; postanal surface and lower femur finely granular; no apparent skinfold across chest. (Male with a median external vocal sac (?).)

Dimensions.—Head and body 40 mm.; head length 14.5 mm., width 15 mm.; femur 19 mm.; tibia 22 mm.; foot 17.5 mm.; hand 13.5 mm.

Color in alcohol.—Dorsum pale wood brown, with traces of a wide dark brown bar between the eyes; each tubercle with a brown spot covering it; femur with four wide, dark brown bars separated by narrow light interspaces, this pattern continued over tibia and foot; forearm with two similar wide brown bars; upper lip with three dark slanting brown spots separated by white lines, the central spot extending to lower eyelid; venter pale buff with a fine reticulated pattern of minute dark dots, entirely covering lower surfaces.

Color in life.—A sketch by Sandig of an adult female, IOC, from Passa Quatro, has the triangular spot on the head and other features of the usual dorsal pattern very greatly reduced. In the vivid orange spots on anterior surface of femur as well as on inguinal region, and in most structural details, the example agrees with typical *catharinae* (see pl. 13, figs. H,J). Its living coloration taken from the sketch was as follows: Back sepia to drab with many small darker spots thickly sprinkled over it; a faint light interorbital bar followed by a suggestion of a dark brown marking fading out quickly into the surrounding dorsal color; limbs olive-buff above with small drab-gray spots and faint reticulations on arm and tibia, stronger across feet and toes, with coarser and darker gray, white-centered reticulations on femur; anterior surface of femur with two or three large orange spots, and another large round orange spot on the inguinal region approximately covering the flat skin-gland which occurs there; a few round orange spots on the inner concealed surface of the tibia and some irregular white spots on the under side of tibia; chin, chest, and belly pearl gray with coarse drab reticulations.

Specimens examined

BRAZIL:

DISTRICTO FEDERAL: Rio de Janeiro, Lutz Coll., B. Lutz, November 1944.

MINAS GERAIS: Passo Quatro, IOC (paratype of *H. flavoguttata*). Zikan, 1923.

RIO DE JANEIRO: Barreira, near Teresópolis, ZSBS 567, Bresslau, Mar. 11, 1914. Petrópolis, USNM 121636, B. Lutz, July 1, 1938. Quitandinho, Lutz Coll. (2), B. Lutz, May 1939. Teresópolis, USNM 121637, B. Lutz, Apr. 1, 1945; ZSBS 799, Bresslau, April 1914.

***Hyla strigilata strigilata* Spix**

PLATE 14, FIGURES D–G

1824. *Hyla strigilata* SPIX, p. 38, pl. 10, fig. 3 (type locality, Bahia).—PETERS, 1872a, p. 680; 1872b, p. 772; 1873a, p. 214.—BOULENGER, 1882a, p. 390.—BAUMANN, 1912, pp. 114, 138, 144, 163.—NIEDEN, 1923, p. 291.—MIRANDA-RIBEIRO, 1926, p. 80, pl. 7, figs. 2, 2, a.

1897. *Hyla strigillata* (sic) WERNER, 1897a, p. 217.

1912. *Hyla catharinae* BAUMANN (part), p. 163 (specimens from Rio de Janeiro).—MYERS, 1946, pp. 13, 31.

Description.—Adult male, USNM 96450, Teresópolis, Serra das Orgãos, Rio de Janeiro. Vomerine teeth in two very small, medially separated patches between the choanae; tongue about three-fifths as wide as mouth-opening, oval, very slightly nicked on its free posterior border; snout moderately elongate, its tip truncate when viewed from above, with a sharp declivity towards the mouth when seen in profile, the upper jaw extending considerably beyond the lower; nostrils more lateral than superior, their inner borders extremely swollen and prominent, so that the tip of the snout appears to have a sharp edge; their distance from end of snout about one-fourth that from eye, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis pronounced, loreal region concave, sloping gently. Eye large and very prominent, its diameter equal to its distance from end of snout; interorbital diameter 1½ times that of upper eyelid, much greater than distance between nostrils. Tympanum very distinct but small, about one-third the diameter of the eye, separated from eye by an interval equal to one-half its own diameter. Fingers webbed only at the base, fourth much longer than second, reaching to base of disk of third which nearly covers the tympanic area; no rudiment of a pollex; toes one-half webbed, the fifth longer than third, disk of fourth covering about three-fourths the tympanic area; an oval inner but no outer metatarsal tubercle; apparently no tarsal ridge; no dermal heel appendage. Body moderately elongate, in the postaxillary region much less than greatest width of head; when hind leg is adpressed, heel reaches between eye and nostril; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to the body, heels greatly overlap. Skin of upper parts with small tubercles which are especially numerous between the eyes, on the temporal region and in the middle of the back; between these tubercles the dorsal skin is rather smooth; a faint granular fold encircling upper part of tympanum and ending above shoulder; chin, chest, belly, and lower part of femur very finely granulate; no apparent skinfold across the chest.

Dimensions.—Head and body 28 mm.; head length 10.5 mm., width 9 mm.; femur 13 mm.; tibia 15.5 mm.; foot 11 mm.; hand 9 mm.

Color in alcohol.—Dorsal surfaces pale wood brown, canthus rostralis with a dark line; upper lip with a dark spot in front of the eye; an indistinct W-shaped dark mark between the eyes and a similar larger one on occiput, especially pigmented at the bases of the small tubercles; groin white, with irregular, large, clove-brown spots; femur with wide seal-brown crossbars that run together on the posterior part of femur to form an irregular longitudinal streak; tibia more faintly crossbarred; ventral surfaces pale pinkish buff, the chin, sides of belly, and anal region faintly spotted with russet.

Color in life.—The following color notes were made from USNM 97747, taken from bulrushes in a marsh at Nova Friburgo: Iris pale metallic wood brown above, ecru-drab below. Body color above drab with light olive reticulations across the middle of the back; a seal-brown triangular marking between the eyes, its apex turned backward, narrowly outlined with a metallic pale border. A seal-brown dorsolateral stripe extending from posterior eye midway to groin. A median and two lateral, sacral, seal-brown spots, rather irregular in shape. Legs olive-buff on femora to buff on feet, with very definite and distinct seal-brown crossbands. Ventral surface drab-gray with a powdering of very uniform, minute, dark dots all over it. This ventral pattern ceases very abruptly as the dorsal spotting begins on the anterior femur and tibia on the sides, instead of blending gradually, as is usually the case.

Variations.—Although proportions, webbing, and other structural characters appear to be more or less constant, there is considerable variation in intensity of pattern. Some individuals are very light, with only a faint interocular bar and a few scattered pigmented areas on the back, and a relatively faint crossbanding of the legs. Others are deep brown, with a prominent, wide, black interocular bar edged anteriorly by a light line; on these the banding across the thighs and particularly the irregular dark line on the front and back of thighs appear particularly intense. Sometimes the dark interocular marking has an anterior prolongation, while often there is a dark W-shaped occipital marking to limit it posteriorly.

Most of the series of *H. strigilata* from near the city of Rio de Janeiro appear to be immature. The largest adult, USNM 96324, measures 37 mm. in head and body length however, which puts it within the average range of size for the series of *H. brieni* from Alto da Serra, São Paulo, although it is far below that of large females of *H. catharinae* from Santa Catarina. The pigmentation on the Rio de Janeiro series does not seem to be so intense as in the Alto da Serra frogs. Three freshly collected adults from Agua Limpa, in Ouro Prêto, Minas Gerais, USNM 98021–3, are nearly as dark as the Alto da Serra specimens.

Remarks.—This species has a whispering voice, a note like *tschw, tschw, tschw*, often repeated. Adults are taken in trees, under stones, and near still water. The species is very common on Tijuca in the city of Rio de Janeiro, and is found elsewhere in the State, as well as in Minas Gerais and in São Paulo. The gelatinous eggs have been hatched into tadpoles which metamorphosed in several months in Dr. A. Lutz's laboratory. A vial of tadpoles, USNM 96256, was taken in September 1929.

At Nova Friburgo the species was secured at night in a marsh where the adults were floating in the shallow water or clinging low on the bulrushes. When the collector Joaquim Venancio imitated their call, they answered but did not come nearer.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, USNM 70519–20, 81103–5, 96364–9, A. Lutz; MZUM 67774, 68784, A. Lutz; ZSBS 25/47 (2), A. Lutz, 1932. Sumaré, USNM 96323–6. Tijuca, USNM 96245–56, A. Lutz, Sept. 10, 1929; USNM 96316, A. Lutz, 1923.

Amazonas: Teffé, ZSBS 2531/0 (2) (cotypes of *H. strigilata*), Spix.

Bahia: Bahia, ZSBS 2369/0 (cotype of *H. strigilata*), Spix; USNM 97110–1, Davis, March 1933. Caravellas, ZMB 7504, Wucherer.

Minas Gerais: Agua Limpa, in Ouro Prêto, USNM 96989, A. Lutz; USNM 98021–3, Cochran, Dias, and Venancio, Mar. 19, 1935.

Rio de Janeiro: Angra dos Reis, USNM 70521, 96483–94 and 96501–2, A. Lutz. Barreira, near Teresópolis, ZSBS 567, Mar. 11, 1914. Barro Branco, MZUM 104174 (9) and 104237 (2), J. R. Bailey, 1941. Nova Friburgo, USNM 97747, D. Cochran, B. Lutz and J. Venancio, May 11, 1935. Teresópolis, USNM 96449–51, A. Lutz, November 1929; ZSBS 799, April 1914.

6. *albomarginata*—group

The frogs of the *albomarginata* group, *albofrenata*, *albomarginata*, *albosignata*, *musica*, and *prasina*, are predominantly green in color. There are other green frogs, notably those of the *aurantiaca* group, but they are obviously of another stock.

The absence of an outer metatarsal tubercle characterizes this group, and its member species are all moderately large in size, from 44 through 59 mm. in the adult. A rudiment of a pollex in most of the species relates the group somewhat to the frogs of Group 3. A heel appendage is present in three species; the others have distinct glandular lines along the outer limb borders. The leg is not excessively long in any, as the heel does not extend beyond the nostril. The tibia is strong, but not so wide in proportion to its length as in the frogs of the *rubra* group.

For a statistical analysis of members of the *albomarginata* group here discussed, see pages 373 and 379.

Key to the frogs of Group 6 from southeastern Brazil

*a*¹. Glandular dorsolateral folds present.
  *b*¹. No dermal heel appendage; heel reaching to between eye and nostril. **prasina** (p. 171)
  *b*². A dermal heel appendage; heel reaching to end of snout. **albomarginata** (p. 164)
*a*². No dorsolateral folds present.
  *b*¹. A dermal appendage on heel, or at least a conical tubercle.
    *c*¹. Toes three-fourths webbed; disk of fourth toe covering one-third tympanum; heel reaching to center of eye; no rudiment of a pollex. **albofrenata** (p. 161)
    *c*². Toes one-half webbed; disk of fourth toe covering one-half tympanum; heel reaching beyond anterior border of eye; an enlarged tubercle at base of first finger . . . . **albosignata** (p. 168)
  *b*². No dermal appendage on heel . . . . **musica** (p. 170)

Hyla albolineata Lutz and Lutz (1939a, pp. 69, 84, pl. 1, fig. 2; type locality, Teresópolis, Rio de Janeiro) is said by its authors to be related to *H. prasina*. It should therefore fall in Group 6, but as no examples of it have been available to me, I can make no comments upon it.

Hyla albofrenata A. Lutz

PLATE 15, FIGURES A–C

1924. *Hyla albofrenata* A. LUTZ, 1924a, p. 241 (type locality, environs of Rio de Janeiro); 1926a, pp. 7, 14.—MYERS, 1946, pp. 12, 30.—B. LUTZ, 1949b, p. 559, fig. 1.

Description.—Adult female, USNM 96340 (cotype), Paineiras, city of Rio de Janeiro. Vomerine teeth in two short, heavy, well separated, transverse series between and behind the posterior level of the choanae;

tongue two-thirds as wide as mouth-opening, cordiform, its posterior border slightly notched and partly free; snout almost right-angled and pointed when viewed from above, rounded in profile, the upper jaw projecting somewhat beyond the lower; nostrils lateral, slightly projecting, their distance from end of snout about two-fifths that from eye, separated from each other by an interval equal to about three-fifths their distance from eye. Canthus rostralis very well defined; loreal region concave. Eye large, prominent, its diameter slightly less than its distance from nostril; interorbital diameter about 1½ times the width of the relatively narrow upper eyelid, much greater than distance between nostrils. Tympanum large, distinct, about three-fourths the diameter of eye, separated from eye by an interval equal to about one-half its own diameter. Fingers almost one-half webbed, fourth much longer than second, reaching to disk of third, which covers about one-half the tympanic area; a distinctly enlarged tubercle on outer part of first finger, representing the rudiment of a pollex; a heavy glandular ridge along outside of forearm ending in a tubercle on the elbow; toes three-fourths webbed, fifth slightly longer than third, disk of fourth toe covering about one-third the tympanic area; a prominent projecting inner metatarsal tubercle but no outer one; a slight outer tarsal ridge ending in a distinct, triangular dermal appendage on heel. Body not elongate, in postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches to middle of eye; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts smooth; a pronounced glandular ridge encircling upper part of tympanum and ending above the shoulder in a low gland; skin of chin smooth, of throat and chest finely granular, of belly a little more heavily granular, of lower posterior femur less heavily granular; no apparent skinfold across chest. (A pair of external vocal sacs in the male.)

Dimensions.—Head and body 38 mm.; head length 13 mm., width 12.5 mm.; femur 18 mm.; tibia 19 mm.; foot 15 mm.; hand 13.5 mm.

Color in alcohol.—The green hylas all appear to lose their color within a few days after preservation, and from then on change but little. The described individual is a pale buff, immaculate below, minutely covered with very small olive dots on upper surfaces of head, body and tibia. No other pattern is now visible.

Color in life.—From a sketch by Sandig. Above pale grass green to apple green, lighter on anterior femur, forearm, and foot; disks of toes and fingers straw yellow above; a few small black dots scattered over head and anterior part of back. Throat and chest blue green to beryl green, belly deep olive-yellow, thighs olive-green, extremities pale and translucent, so that the green bones show through; lower surfaces of hands and feet deep wax yellow, the disks saffron below. Iris light prune purple, with a very fine network of dark lines going through it; an indigo band surrounding it; pupil black, nearly round to transversely elongate. Dr. A. Lutz informed me that in life the eyes are very prominent, and that the pupil is transversely elongate and the iris distinctly copper-colored, with fine dark veinlike marks.

Variations.—The heel carried forward may reach between the posterior border of the eye to the nostril. The heel appendage is distinct in some frogs, but may be small or even tuberclelike in others. The coarse postanal granules are occasionally arranged in a transverse row, as they frequently are in *H. albosignata.*

Remarks.—The very loose skin of the trunk may fall into a fold in the sitting position. This fold is not permanent, disappearing when the frog is stretched to its full length.

Some elevated white lines are prominent upon the external part of the forearm, hand, tarsus, and foot, as well as on the canthus rostralis. The decorative spots which occur on lateral parts covered during repose in many frogs are absent in *H. albofrenata.* There is no indication of dark crossbars on the extremities. The general color is bright grass green turning to yellowish on the limbs, throat and belly. The green color during life is quite constant, but disappears in preserved specimens, changing to ivory white which may be dotted with dark spots. In life the very transparent tissues allow the green bones to show through the flesh; the viscera, with a whitish spot formed by the tendinous peritoneum, may be indistinctly seen. The iris is characterized by a coppery red tone.

In young examples the tympanum is not distinctive in color, hence not apparent. In adults the tympanum is more distinct, but does not contrast with the surrounding skin. The vomerine teeth, faint in the young, become distinct in the adult.

The tadpoles reach a length of more than 5 cm., of which two-thirds is tail, which is not broad but very long. The lower membrane on the tail reaches almost to the body, but the upper is shorter. The tip is quite rounded. The tadpole is dark at first, but, as metamorphosis begins, light spots appear in the caudal region, sides, and back. These increase, and gradually the tadpole becomes a very light green, the tail remaining dark.

This frog in the adult stage rarely appears, notwithstanding the frequency with which one meets young ones and tadpoles in water, still or running. The adults habitually hide in vegetation above the ground and are protected by the uniform green color of the exposed parts. Their song suggests the sound of water dripping into an empty bottle.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, USNM 81116–8; ZSBS 67/1947, A Lutz, 1932. Paineiras, slope of Corcovado, USNM 96339–45 (cotypes), A Lutz, November 1923. Sumaré, USNM 96319 (cotype), A Lutz, October 1923, and 96320–2, December 1923. Tijuca, USNM 96228–34, A Lutz, November 1920; USNM 96235–6, A Lutz, December 1922; USNM 96237, A. Lutz, Nov. 2, 1928. Tijuca, Sumaré, and Corcovado, USNM 96347–8 (cotypes), A Lutz.

Rio de Janeiro: Angra dos Reis, USNM 96478 (cotype), Pugas, Apr. 26, 1924. Barro Branco, MZUM 104179 (2), Bailey, 1941. Mountains of Rio de Janeiro, USNM 96352 (2 tadpoles), A. Lutz. Serra da Bocaina, USNM 96564–7 and 96601–7, A. Lutz, Jan. 2–19, 1930.

Hyla albomarginata **Spix**

Plate 15, Figures d–f

1824. *Hyla albomarginata* Spix, p. 33, pl. 8, fig. 1 (type locality, Bahia).—Tschudi, 1838, p. 72.—Duméril and Bibron, 1841, p. 555.—Günther, 1858, p. 98; 1901, p. 284.—Reinhardt and Lütken, 1862, p. 186.—Steindachner, 1867, p. 57.—Cunningham, 1871b, p. 468.—Peters, 1872b, p. 771.—F. Müller, 1882, p. 140.—Boulenger, 1882a, p. 356; 1900, p. 56.—Werner, 1897a, p. 220.—Wandolleck, 1907, p. 13.—Baumann, 1912, p. 101; 1917, pp. 132, 143.—Beebe, 1919, p. 207; 1925, p. 124.—Nieden, 1923, p. 260.—Miranda-Ribeiro, 1926, p. 74.—Mertens, 1926a, p. 4; 1928, p. 298; 1930, p. 162; 1950, pp. 174–175, 180, fig. 4.—A. Lutz, 1927, pp. 38, 43.—Ahl, 1931b, p. 2 (in sep.), fig.—Crawford, 1931, p. 33.—Parker, 1935, p. 511.—Myers, 1946, pp. 13, 31.—B. Lutz, 1949b, p. 555, fig. 2.

1824. *Hyla cinerascens* Spix, p. 35, pl. 8, fig. 4 (type locality, Ecgá [Ega] on the Solimões).

1824. *Hyla infulata* Wied, 1824 b, p. 671 (type locality not given); 1825, p. 533.—Burmeister, 1856, p. 97, pl. 30, figs. 1–6.

1830. *Hypsiboas albomarginatus* Wagler, p. 201.—Fitzinger, 1843, p. 30.—Cope, 1886, p. 273.

1860. *Phyllobius albomarginatus* Fitzinger, p. 412.

1860. *Phyllobius exanthematicus* Fitzinger, p. 413.

1930. *Hyla massarti* deWitte, 1930a, p. 225 (type locality, Botanical Gardens, city of Rio de Janeiro).

Description.—Adult female, USNM 97244, Manguinhos, city of Rio de Janeiro. Vomerine teeth in two heavy, well separated, posteriorly diverging patches between the rather large choanae; tongue three-fourths the width of mouth-opening, cordiform, with a deep notch on its free posterior border; snout moderate in length, rounded when viewed from above, truncate and sloping backwards in profile, the upper jaw scarcely extending beyond the lower; nostrils superolateral, only slightly projecting, their distance from end of snout about one-half that from eye, separated from each other by an interval equal to three-fifths their distance from eye. Canthus rostralis very well defined, loreal region slightly concave and sloping greatly outwards. Eye large, prominent, its diameter equal to two-thirds its distance from end of snout; interorbital diameter about 1½ times that of upper eyelid which is moderately narrow, almost twice as great as distance between nostrils. Tympanum moderate in size but very distinct, equal to one-half the eye diameter, separated from eye by an interval equal to one-half its own diameter. Fingers one-half webbed, fourth considerably longer than second, reaching halfway onto disk of third, which nearly covers the tympanic area; a pronounced dermal ridge along outside of forearm, extending along outer finger; a rudiment of a pollex showing as a blunt knob on inside of first finger; toes three-fourths webbed, fifth slightly longer than third, disks of toes much smaller than those of fingers, that of fourth toe covering only about one-half the tympanic area; a blunt inner but no outer metatarsal tubercle; a blunt, low ridge along inside of tarsus, and another slightly more apparent along outside of foot and tarsus, ending on the heel in a dermal tubercle, which suggests a distinct conical dermal appendage; body elongate but rather heavily built, width in postaxillary region somewhat less than greatest width of head; when hind leg is adpressed, heel reaches to end of snout; when limbs are laid along the body, knee and elbow considerably overlap; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts fairly smooth, except for some scattered round spots supposed to be guanine which are slightly raised; a narrow but sharp glandular ridge beginning behind eye, extending over tympanum and straight back along the sides halfway to groin; a pronounced glandular ridge above anus; skin of throat and chest smooth, of belly and lower part of thighs heavily granular; a skinfold across the chest and another across the throat. (A large internal vocal sac in the male.)

Dimensions.—Head and body 56 mm.; head length 19 mm., width 21 mm.; femur 28 mm.; tibia 30 mm.; foot 22 mm.; hand 16 mm.

Color in alcohol.—Above, very pale olive-buff; an irregular, wide, drab-gray crossband between the eyes, extending to outer edge of eyelids; a heavy dotting of very fine drab spots over posterior head and back, slightly less concentrated on upper surfaces of limbs and on snout and upper lip; ventral surfaces very pale olive-buff, immaculate.

Color in life.—The following color notes were made from a typical example from a series of living frogs from Manguinhos collected on January 23, 1935: Upper surface brilliant yellowish apple green, with guanine spots appearing lemon-yellow. (According to A. Lutz, the guanine spots are white, being composed of white crystals, but the yellow appearance may be due to the overlying skin.) A narrow dorsolateral stripe of citron yellow. A postfemoral patch of orpiment orange, and a suffusion of this color somewhat faded out on lower surfaces of the legs and posterior part of belly, although brighter on the webs between the toes. Ventral surface malachite green, with suffusion of orange on sides and on the anterior femur. Posterior part of belly terre verte, the skin transparent, showing the peritoneum. Mouth green inside, and bones green. Iris white or silvery; pupil narrow, transversely elliptical with a triangular median lobule on its upper and lower margin.

Just after preservation, the whole series was compared, with the following notations: Dorsum apple green, sometimes a very brilliant deep emerald or olive-yellow, or golden deep citron yellow. A very bright cadmium-orange spot constantly present on posterior lower half of distal part of femur. A sulphur-yellow stripe above anus. A whitish patch below anus. Another sulphur-yellow stripe from eye halfway to groin along granular dorsolateral ridge. Webs of toes and fingers deep cadmiun orange. Throat oil green, the central skin orange on the wrinkles. Belly chrome yellow. The green flesh shows through on the legs. Inside of mouth deep sea green to beryl green. Tongue lighter glaucous green. Guanine spots sulphur yellow. Iris french gray.

A metamorphosing tadpole with legs, from this series, displayed these tints: Dorsum bright apple green. A citron-yellow line from eye to shoulder. Anterior part of head and snout lightening to nearly citron yellow. Upper limbs olive-yellow. Chin verdigris green, belly malachite. Upper part of femur light oil green. Hands brilliant lemon yellow, feet gamboge. Apparently the intense orange color does not develop at this early age.

Variations.—This species is rather easily recognizable over the whole of its very considerable range and does not appear to vary much in any important characteristic. The Pernambuco frogs from Tapera and Zona da Matta have longer and sharper snouts than the described specimen, with the nostrils more projecting and nearer to the end of the snout, while the heel on the adpressed hind limb reaches somewhat beyond the tip of the snout. These differences are not significant, however, as other frogs in the Manguinhos series have equally long legs and projecting nostrils and less rounded snouts. The seven examples from Hansa, Santa Catarina, are not unusual in any feature unless it be that guanine spots are lacking in all, while most of the Manguinhos frogs show at least a few. In the frog from Bonito, Pernambuco, the vomerine teeth are medially in contact; this condition is approximated in some of the southern specimens. So prominent is the dorsolateral glandular ridge on the front half of the body that it shows up even in very old and soft specimens such as the immature frog from "Brazil," USNM 12775.

Remarks.—I have examined the type of *H. massarti*, MRHN Reg.

75, and find it without doubt an immature *H. albomarginata*. The cutaneous glands on heel, above anus, and on anterior dorsolateral region stand out with the distinctness characterizing this species, while every detail of head and limb structure of *massarti* can be matched in other immature *albomarginata* either from Manguinhos or neighboring localities.

The voice of this frog when it begins to sing is a *tang, tang*, followed by a continuous *ccrrrr* as if someone were filing iron.

The male has an internal gular vocal sac, which is quite large and covered by a citrine membrane. There is a rudiment of a pollex on the inner margin of the hand of the male, but it is not a sharp spur as in the larger species.

The iris is of a metallic silver hue all over. This color distinguishes the species from all other green *Hylas* even during metamorphosis. When the frog is asleep, the pupil shows as a dark slit in the silver plate of the iris. Another distinguishing color character of this species is the brilliant orange seen on the flanks and on the webs of hand and foot. These two features render the species quite unmistakable in life.

Hyla albomarginata may climb to the tops of trees, but during the breeding season it seeks water in ditches and ponds, sitting on aquatic plants. It is nocturnal and appears to sleep deeply in the daytime.

It is a rather large species, although the total length of 60 mm. indicated by Nieden seems exceptional. It always appears thin on account of its very slender extremities. In a sitting position its back is very flat.

The tadpole is large and dark, and is found in still water.

Specimens examined

BRAZIL: USNM 12775, Beddome; ZMB 24190, 16-5356, 16-3104–7; UZMK 17; BM 52.12.11.9; NHMW (3; cotypes of *Phyllobius exanthematicus*), Frauenfeld, 1857–9 (cruise of the *Novara*); NHMW (7), Zelebos, 1857–9 (cruise of the *Novara*); MRHN IG 4802 Reg. 346 (3).

Amazonas: Teffé River, ZSBS 2498/0 (2; cotypes of *H. cinerascens*), Spix.

Bahia: Bahia, ZSBS 2370/0 (type of *H. albomarginata*), Spix; ZMB 16-7496, Wucherer; ZMB 16-3103, Wagler; UZMK 13 and 14, Kypn; UZMK 16, Andria, Jan. 4, 1871; BM 69.2.22.4, Cutter; BM 61.3.23.6, Wucherer. Ilhéus, Itabuna, BM 1924.9.20.5, Matthews.

Districto Federal: Jardim Botanico, MRHN Reg. 75 (type of *H. massarti*), Massart, Aug. 31, 1922. Manguinhos, USNM 97244–7 and 99115–8, Venancio, January–May 1935. Pico de Tijuca, MZUM 104143–5 (18), Bailey, 1941. Rio de Janeiro, USNM 70510–5, Metcalf, September–October 1925; USNM 81110–1, 96353, A. Lutz, 1930; ZMB 16-7283, Burmeister; UZMK 21, Reinhardt; BM 68.9.16.24, Cunningham; BM 55.4.18.19, Fry; ZSBS (1), A. Lutz, 1932; ZSBS 56/1947 (4), A. Lutz. Santa Alexandrina, USNM 96377, A. Lutz, October 1923.

Espírito Santo: MP 270.
Maranhão: Cotinguiba, UZMK 17, 18, 24, Kypn.
Pará: BM 50.4.8.17.
Pernambuco: Bonito, USNM 48856, Branner. Tapera, USNM 97065, Pickel, Aug. 21, 1930. Zona da Matta, USNM 97091–2, Pickel, July 1926.
Santa Catarina: ZSBS 6/1915, Schlüsser. Hansa, USNM 98768–74, Globig, 1935. São Bento, USNM 97154 and 97158, Nahderer, 1923–4.
São Paulo: MP 103. Juquiá, 8 km. north of, MZUM 104165, 104204 (2), Bailey, 1941. São Sebastião, ZSBS 27/1907, Rosenberg, 1904.
ECUADOR: MRHN IG 3701 Reg. 346 (2), deVille. Pastaza, ZSBS 2500/0, M. Wagner.
COLOMBIA: Chorrera de la Elsa, north of Cali, USNM 107639, Killip, Apr. 3, 1939. La Esperanza, 1,250 meters altitude, MRHN 12175, Robá, 1937. Río Tiquié, tributary to Río Waupes, USNM 65438–9, McCreagh.
SOUTH AMERICA: BM RR 1936.12.3.118, Charles Darwin.

Hyla albosignata Lutz and Lutz

Plate 15, Figures g–i

1938. *Hyla albosignata* Lutz and Lutz, p. 185 (type locality, Alto da Serra, São Paulo).—B. Lutz, 1949b, p. 562, fig. 3.

Description.—Adult male, USNM 96781 (paratype), Alto de Serra, São Paulo. Vomerine teeth in two heavy, well-separated, anteriorly converging patches behind the posterior level of the choanae; tongue about three-fifths the width of mouth-opening, cordiform, with an indentation on its partially free posterior border; snout moderately elongate, bluntly pointed when viewed from above, truncate and sloping backwards in profile, the upper jaw scarcely extending beyond the lower; nostrils more lateral than superior, slightly projecting, their distance from end of snout about one-third that to eye, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis poorly defined, loreal region flat and sloping outwards. Eye large, very prominently bulging, its diameter three-fourths its distance from end of snout; interorbital diameter about 1½ times that of upper eyelid, which is very narrow, much greater than distance between nostrils. Tympanum large, very distinct, equal to three-fourths the eye-diameter, separated from eye by an interval equal to one-third its own diameter. Fingers one-third webbed, fourth much longer than second, reaching halfway on disk of third, which covers about one-half the tympanic area; a pronounced dermal ridge along outside of forearm, extending along outer finger; no pronounced rudiment of a pollex; toes slightly more than one-half webbed, third and fifth subequal, disk of fourth covering one-half the tympanic area; a very pronounced, almost sharp-edged inner metatarsal tubercle but no outer one; a rather faintly marked narrow ridge along inside of tarsus, and another equally faint along the outside; a similar ridge on outside of forearm; a pronounced dermal appendage on heel; body elongate but rather heavily built, in postaxillary region only slightly less than greatest width of head; when hind leg is adpressed, heel reaches to just beyond anterior corner of eye; when limbs are laid along the body, knee and elbow fail to meet by a considerable interval; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts very minutely glandular, but without pustules anywhere except in the anal region, where there is a row of about eight pustules more or less confluent below the anus followed by two or three additional rows of pustules extending onto the lower proximal surface of femur; a very pronounced glandular ridge above anus; a very faint, low glandular ridge encircling upper part of tympanum and fading out before the shoulder is reached; skin of throat and chest very minutely shagreened, that of belly and lower and posterior parts of femur minutely granular; no apparent skinfold across the chest. A median external vocal sac.

Dimensions.—Head and body 45 mm.; head length 15 mm., width 15 mm.; femur 20 mm.; tibia 23 mm.; foot 19 mm.; hand 13 mm.

Color in alcohol.—Above pale cream buff, immaculate except for a powdering of very minute dark dots on snout and anterior half of back, with a slight concentration of these dots on the dermal appendage and outside of foot, as well as on the ridge above the anus; ventral surface also pale cream buff, immaculate.

Color in life.—From color sketch by Sandig. Parrot green on the back, fading into citron yellow on the extremities, the latter tint particularly apparent on hands and feet. Ventral surface bottle green to grass green. Above the anus a white or yellowish transverse line. Below the anus a very characteristic group of small yellowish glandular points, 30 to 40 in number and resembling pimples, called milia (little seeds); these are grouped in transverse rows which diminish in breadth towards the anus. Tympanum apparently of the same color as the surrounding skin. The most prominent character, by itself sufficient to identify the species, is the color of the iris—cadmium orange in the peripheral half, fading to light gray in the middle. Transverse pupil appears as a black slit in the sleeping state and as a narrow black ellipse when the animal is awake.

Variations.—Another adult from Alto da Serra, USNM 96782, is practically identical in color and structural characters with the described specimen. A young frog from Bonito, just metamorphosed, has small black dots widely scattered over its dorsal surface. A third adult, MP 248, has, in addition to the minute dark dots on the dorsal surface which appear to characterize this species, larger irregular white spots (presumably guanine) scattered over the back. These were probably lemon yellow in life, as are those occurring on the species *Hyla albomarginata*.

Remarks.—*H. albosignata*, a mountain species, has always been found at altitudes of 800 meters and over.

From notes by Dr. B. Lutz, Nova Friburgo, December 11–17, 1935: "At night, by the waterfall of a brook in a wooded area, one *Hyla albosignata* was caught after a very long wait, in a place prepared by Joaquim [Venancio] who had cut the excess vegetation in the daytime. It was in the earth under roots of grass, and gave a varied call, at a distance sounding one note, and nearby a kind of whining croak that prepared us for a *Paludicola*. We were greatly surprised when we extracted this green male, very much swollen, with a hugely distended median vocal sac. It alternately dilated and contracted the body slightly. The sides of the body were very greatly extended by two enormous masses—lungs perhaps. The frog was in a state of greatest excitement and continued so."

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96644, A. Lutz, Dec. 15-31, 1931.

São Paulo: Alto da Serra, USNM 96781–2 (paratypes of *H. albosignata*), A. Lutz, Jan. 25, 1924; IOC (paratype); MP 248.

***Hyla musica* B. Lutz**

Plate 16, Figures a–c

1949. *Hyla musica* B. Lutz, 1949b, pp. 565, 576, fig. 4 (type locality, Campos das Antas, the Organ Mountains National Park, Teresópolis, Rio de Janeiro, altitude 1,200 m.).

Description.—As I have examined no examples of this species, the original description is given here:

> Differential diagnosis: A green tree-frog closely akin to *H. albofrenata* and especially to *H. albosignata*, which are also from the rain and mist forest of the Brazilian Maritime Range. In life it can be distinguished by the presence of nuptial excrescences outside the first finger of the breeding male, the delicate skin and the slimy secretion which irritates the conjunctiva without coming in contact with it. It can be separated from *H. albofrenata* by the larger size, the ventral outline of the head, the light iris, the absence of the frenal line and of the pointel heel tubercle and by the presence of heavy, wide glandular ridges on the forearm and tarsus. Though nearer to *H. albosignata*, it is less heavy in build, has a shorter and wider snout and lacks the rows of yellow, milium-like, post-anal glands, the yellow colour on the hypochondria, forearm and tarsus, palm and sole and the bright colour of the iris. It is the only regional arboreal green Hyla without any appendage on the heel.
>
> Description: Body robust but not heavy, slightly flattened and tapering somewhat towards the groin. Head slightly shorter than wide, or length and breadth subequal. Hindlimb variable in length, the tibiotarsal articulation

reaching in front of the eye, but not to the nostril, when adpressed. Tibia and femur almost equal in length so that the heels overlap very slightly when placed parallel to each other. Forearm thick. Snout short, rounded to oval from above, projecting slightly over the lower jaw from the side, with marked, curved, canthus rostralis, truncate in front and steep, excavated loreal region. Ventral outline of the head and mouth wider and shorter than in *H. albofrenata.* Vomerine teeth in short, separate, slightly curved groups between and behind the choanae. Tongue flat, disk-shaped, hardly free or emarginate behind. Eye fairly prominent, slightly shorter in diameter than the distance from its anterior corner to the tip of the snout. Nostrils very small, lateral, inserted obliquely below the anterior corner of the canthus. Tympanum small, two-fifths of the diameter of the eye, separated from it by an interval almost equal to its own diameter, covered above by a fold to the axilla. Interorbital space double or almost double the width of the upper eye lid. First finger much shorter than the second, fourth slightly longer. Fingers about half-webbed, but with fringes along the digits. A callosity below the first finger. Vestiges of nuptial excrescences outside it, more distinct in glandular males with thick forearms. Third and fifth toes subequal. Foot about two-thirds webbed, in some more, as the length of the web differs, with fringes along the digits. A white line on the edge of the lower jaw, a very distinct glandular ridge on the forearm and hand, tarsus and foot, outlining the contour of the joints in glandular specimens, but not produced into appendages. A short supra-anal ridge and a few scattered, round, pustules near the anus and on the mid-line of the ventral aspect of the thigh but no serried rows of miliumlike glands as in *H. albosignata.* Skin delicate, very minutely granular on the abdomen and the postero-ventral aspect of the thigh.

SIZE: 44–50 mm., from snout to vent.

COLOUR in alcohol ivory.

TYPE LOCALITY & TYPES: The Organ Mountains National Park at Theresopolis. Alt. 1200 ms. above sea level at km. 4.5 of the trail to the top of the Range; 22° 26′ 14″ Lat. S. Types in the Museu Nacional in Rio de Janeiro.

***Hyla prasina* Burmeister**

PLATE 15, FIGURES J–L

1856. *Hyla prasina* BURMEISTER, p. 106, pl. 31, fig. 2, 2,a, b, d, e, (type locality, Neu-Freiburg [=Nova Friburgo, Rio de Janeiro].)

Description.—Adult male, IOC, Nova Friburgo, Rio de Janeiro. Vomerine teeth in two small, round, distinct, well-separated patches between the choanae; tongue a little more than two-thirds the width of mouth opening, very broadly cordiform, slightly indented on its posterior border which is only narrowly free; snout short, bluntly rounded when seen from above, slanting forwards in profile, the upper jaw projecting slightly beyond the lower; nostrils more superior than lateral, projecting, their distance from end of snout about one-third that to eye, separated from each other by an interval a trifle less than their distance from eye. Canthus rostralis curving, fairly distinct because of the flat sloping loreal region, below which the upper lip bulges out, leaving a diagonal furrow from eye to nostril below the loreal region; diameter of eye equal to its distance from end of snout;

interorbital diameter 1¼ times the width of the upper eyelid, greater than interval between the nostrils. Tympanum distinct, equal to one-half the diameter of eye, separated from eye by a distance equal to half its own diameter. Fingers quite long, webbed at the base, fourth much longer than second and reaching nearly to disk of third which covers one-half the tympanic area; a minute but sharp spine at base of first finger; toes one-half webbed, fifth slightly longer than third, disk of fourth covering about one-third the tympanum; a small inner but no outer metatarsal tubercle; a definite inner tarsal ridge; a similar ridge across heel but no true dermal appendage on heel. Body elongate, in postaxillary region narrower than greatest head width; when hind leg is adpressed, heel reaches to between eye and nostril; when hind limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts smooth; a slight glandular ridge beginning on canthus rostralis, continuing behind the eye over the tympanum and down the sides nearly to the groin; a transverse glandular line in front of anus; a very faint glandular line along outside of forearm and tibia; skin of throat and chest very coarsely granular, that of belly and lower femur heavily but more finely granular; no apparent skinfold across the chest. A heavy external vocal sac across entire throat appearing as)(-shaped skinfolds almost at the commissures of the lower jaws.

Dimensions.—Head and body 55 mm.; head length 17 mm., width 18 mm.; femur 27 mm.; tibia 28 mm.; hind limb 87 mm.; fore limb 35 mm.

Color in life.—From notes by Dr. B. Lutz: On top, light saturated enamel green, uniform except for a wavy interrupted line which shines golden at night and is paler by day but always has a metallic sheen. It does not quite reach the groin and continues from the fold over the tympanum; lines similar to this found on forearm and on foreleg. This line is the only break in the uniform green dorsal ground. Tympanum light brown. Iris golden, broad. Pupil horizontally elongate. Edge of mouth with metallic sheen, not white, as described by Burmeister. Throat citrine with darker network. Abdomen and lower side of limbs adjacent to body white. Both abdomen and these parts with a fine lavender network. Outside of thigh spotted in weak orange and light brown spots. In captivity the frog became grayish tan where it was green; the metallic wavy line persisted. The color changes, is sometimes darker, sometimes lighter, sometimes mother-of-pearl, but is never silver. Underside granular with yellow pigment on the gula. Sometimes there is a little brown on the lower part of the wavy line, but mixed with it and not straight.

Color in alcohol.—Dorsum uniform olive-gray; an interrupted narrow white dorsolateral line from above tympanum nearly to groin, and a similar line along outer forearm and tibia; posterior femur buff with 7 or 8 short vertical sepia spots becoming fainter proximally; anterior femur buff with a fine powdering of sepia dots; skin of chest and throat olive-gray, the large granules white; posterior half of belly and lower surfaces of hind legs deep buff; upper surfaces of hands and feet olive gray, their lower surfaces buff powdered with sepia dots.

Remarks.—Regarding *Hyla prasina*, Dr. B. Lutz has sent the following notes: "On Sunday the 15th, a trip to the edge of the marshy ground where clay is extracted for bricks produced a veritable chorus of *Hyla polytaenia, pardalis, nebulosa, Phyllomedusa rohdei, Ceratophrys boiei, Bufo*, et cetera. Some were caught. Joaquim [Venancio] heard a new note, which later I also got on coming closer, *Cararú, cararú*, rough and loud. We finally located the sound in a deep clay pool. I thought it came from a small island; Joaquim, from the other side of a narrow causeway. He climbed the crumbling bank while I stayed below and illuminated the spot on which he was working. Suddenly I saw a big frog leap at him. He caught it, and afterwards said it was lucky the frog did launch itself at him, for otherwise it would have been out of reach. The creature was very beautiful—deep green like enamel, with a golden line running along the sides of back and the same line on forearm and foreleg. It is evidently *Hyla prasina*, which Burmeister described from Friburgo and which has been considered a doubtful species. I still have it with me. It is big and fat and gobbles the grasshoppers I give it, but has become a grayish tan. The golden line is still visible, sometimes stronger, sometimes weaker in color, never silver, perhaps slightly mother-of-pearl, as Burmeister describes it . . . Iris golden, broad." A letter dated February 15 notes that the specimen "has turned slate-gray with a vestige of white where the golden stripe was, just like the *Hyla raddiana* specimens we have [from Argentina]."

In 1938 this specimen was shown to Dr. Lorenz Müller, who pronounced it the same as the type of *Hyla prasina* which he had seen at Göttingen.

Specimen examined

BRAZIL:

Rio de Janeiro: Nova Friburgo, IOC, B. Lutz and Venancio, Dec. 15, 1935.

7. *marmorata*—group

The group here represented by *marmorata senicula* and *microps* is distinct among Brazilian hylids because of the several features common to all its members not found in combination in any other group: Usually an axillar "wing" of skin; a short blunt snout nearly truncate at the tip; a more or less warty or glandular appearance of the skin around the margin of the lower lip; dermal serrations along outer limb borders; disks and webs on toes and fingers relatively large; hind legs rather short; a similar marbled color pattern on the back, and usually a great deal of orange on the femur and on the membranes between the fingers and toes.

Hyla microps seems to deserve full specific rank because of its constantly white upper lip not found in *marmorata* subspecies, and its smaller adult size. Structurally it differs mainly in having slightly less extensive webs and in having the axillar "wing" less well developed than in the subspecies of *marmorata*. Regarding the latter, it is still somewhat doubtful if *senicula* and *melanargyrea* deserve even subspecific rank under *marmorata*, so great is the variation in each of these forms as to degree of webbing on hands and feet as well as color pattern. Except for the geographical separation and the resulting slight variations in color pattern that appear to have a regional significance, it might be impossible to keep them apart. The apparently complete webbing of toes and fingers in typical *marmorata* from Guiana is approximated in many of the southern and western individuals of *senicula* and *melanargyrea*. Although some of the *senicula* from Rio de Janeiro are uniformly pale on the ventral region, a few show a darker tone on the under part of the legs, but this does not approach the highly mottled lower legs and dusky chin and belly of *melanargyrea* or the black inferior tibia and tarsus and spotted chin and belly of typical *marmorata*, from Guiana.

Hyla giesleri Mertens (1950, p. 185, figs. 8, a, b) from Barro Branco, Colonia de Imbarié, Rio de Janeiro, belongs in this group, but as I have seen no examples, further comment is withheld.

Hyla marmorata senicula Cope

PLATE 16, FIGURES D–G

1868. *Hyla senicula* COPE, p. 111 (substitute name for *Hyla marmorata* Burmeister (not of Daudin); type locality, Corcovado, Rio de Janeiro).—BOULENGER, 1882a, p. 391; 1888c, p. 417; 1903a, p. 69.—BAUMANN, 1912, p. 163.—L. MÜLLER, 1922, p. 171; 1927, p. 266.—NIEDEN, 1923, p. 288.—MERTENS, 1950, p. 188, fig. 10.
1868. *Hyla dasynota* GÜNTHER, p. 488, pl. 38, fig. 2 (type locality, Brazil).—BOULENGER, 1882a, p. 392.—NIEDEN, 1923, p. 289.
1912. *Hyla dasynotus* BAUMANN, p. 163.
1926. *Güntheria dasynota* MIRANDA-RIBEIRO, p. 67, fig. 38.

Description.—Adult male, USNM 96498, Angra dos Reis, Rio de Janeiro. Vomerine teeth in two short, heavy, transverse, narrowly separated patches between the posterior levels of the choanae; tongue conspicuously small, only one-half the width of mouth opening, cordiform, deeply nicked on its free posterior margin; snout short and very bluntly rounded when viewed from above, truncate in profile, the upper jaw scarcely extending beyond the lower; nostrils superolateral, slightly projecting, their distance from end of snout about one-third that to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis very poorly defined, loreal region slightly concave, sloping greatly. Eye very large, prominent, its diameter equal to its distance from end of snout; interorbital diameter equal to that of upper eyelid, also equal to distance between nostrils. Tympanum very distinct, medium-sized, about one-half the diameter of the eye, separated from eye by an interval equal to one-third its own diameter. Fingers one-half webbed, fourth longer than second, reaching to base of disk of third which covers the tympanic area; no projecting rudiment of a pollex but a semicircular disk at base of first finger; toes three-fourths webbed, third and fifth subequal, disk of fourth nearly covering the tympanic area; a small distinct inner but no outer metatarsal tubercle; a very narrow tarsal ridge along the inside of tarsus and a heavy serrate glandular fold along outside of tarsus and foot, with a similar smaller one along outside of forearm; a dermal fold across heel ending in a tubercle, but no true dermal appendage; body only moderately elongate, rather heavy in build, in postaxillary region almost equal to greatest width of head: when hind leg is adpressed, heel reaches to tip of snout; when limbs are laid along the sides, knee and elbow slightly overlap; when hind legs are bent at right angles to body, heels overlap considerably. Skin of upper parts highly glandular, with large pustules which are especially prominent between the eyes and on the occiput and form a glandular ridge on each side of the back behind the axilla; a narrow but distinct glandular ridge encircling the upper part of tympanum and ending in front of shoulder; skin of chin faintly granular, that of throat and chest smooth, that of belly finely granular, with similar granules on posterior part of femur below anus; lower surface of femur nearly smooth. A skinfold across chest. A pair of lateral external vocal sacs.

Dimensions.—Head and body 33.5 mm.; head length 10.5 mm., width 11 mm.; femur 15 mm.; tibia 17 mm.; foot 14 mm.; hand 10 mm.

Mathematical analysis (in percentages of the total length):

	head length	head width	femur	tibia	foot	hand
Number	7	7	7	7	7	7
Mean	30. 0	31. 3	45. 7	50. 4	43. 4	31. 4
Standard deviation	. 86	1. 68	. 88	1. 04	2. 08	1. 90
Variation	2. 9	5. 4	1. 9	2. 1	4. 8	6. 0
Standard error	. 33	. 63	. 29	. 39	. 79	. 72
Range	28. 5– 31. 3	28. 8– 33. 8	44. 1– 46. 2	48. 5– 52. 2	41. 2– 47. 5	28. 9– 33. 9

Color in alcohol.—Dorsal ground color smoke gray; an irregular gray mark on the occiput with anterior prolongations extending onto the eyelids, the whole outlined with a narrow slate-gray line; another irregular, outlined marking on each side of the back; anal region pearl gray, with a dark transverse line across it and another paralleling it in front; anterior and posterior surfaces of femur immaculate burnt umber, the narrow strip of ground color covering the upper surface traversed by three or four dark-edged, brown crossbars; an umber axillary spot; remainder of upper surfaces of legs and arms with more or less distinct, dark-edged brown crossbars; upper lip with alternating diagonal patches of pearl gray and umber; chin pale olive-buff with very fine dark dots; chest and belly wood brown; lower parts of arms and legs russet. The sides of the neck around the vocal pouches of the male are suffused with dark slate color.

Variations.—Considerable color variation occurs among the specimens USNM 96497, 96499, and 96500 (from the same locality as the described specimen). The last mentioned of these is chocolate to seal brown above, with a pale area on the center of the snout; the dark outlines to the dorsal markings nevertheless stand out very clearly; 96499 is intermediate in tone between this dark specimen and the lighter ones, as it has rather heavy dark bandings on the legs but a light dorsal ground color; while 96497 is very much like the described specimen in tone. All of them show on the front and back of the thigh the elongate umber-to-chocolate area that appears to be a rather easily recognizable character of this species. In 96497 the dorsal skin approaches the described specimen in roughness, but the other two are nearly smooth, with only a few very faint pustules appearing on head and on sacrum. Two rather faded specimens, USNM 96495–6, from the same locality, show an almost smooth dorsal skin, perhaps due to their softening in preservative. The dark outlines to the dorsal markings have remained very clear and sharp; 96496 has a conspicuously truncate snout when viewed from above or in profile.

An adult female, from Rio Gugogi, Bahia, is similar in color pattern to the Angra dos Reis frogs, except that the dorsal marking is median, anteriorly bifurcating onto the eyelids and posteriorly onto the sides, and the dark femoral crossbands are not confined to the upper surface but extend onto the light posterior surface, there becoming considerably darkened, so that the rear of the femur is no longer immaculate. In addition, the Bahia frog has a distinct skinfold across its chest; its legs are slightly shorter than those of the described specimen, the heel on the adpressed leg reaching to between eye and nostril, and the elbow and knee not quite touching when limbs are laid along the side; its head is apparently wider in proportion to its length, whereas length and width are equal in most specimens of *senicula*. These facts, taken in conjunction with the light posterior femur invaded by the dark crossbands, renders this individual slightly atypical.

A male from Bonito, Pernambuco, is practically identical with the described specimen from Angra dos Reis except for its slightly greater finger webs.

Remarks.—The life history of this species is unknown. The voice has not been recorded. Although Corcovado, in the city of Rio de Janeiro, is the type locality, being the source of Burmeister's specimen on which Cope based the name *senicula*, no specimens from that city are in the collections at hand.

Specimens examined

BRAZIL: BM RR 1936.12.3.201, Lord Stewart; BM 68.11.16.3 (type of *H. dasynota*); ZSBS 47/1924; MHNP 4811, Claussen; MHNP 4813; MHNP 4814.

Bahia: Rio Gugogi, USNM 54336, Curran.

Minas Gerais: Lagôa Santa, UZMK 57, Warming.

Pará: Peixe Boi, ZSBS 7/1914 (3), Goeldi, 1909.

Pernambuco: Bonito, MCZ 2829.

Rio de Janeiro: Angra dos Reis, USNM 96495–96500, A. Lutz and Venancio, November 1924. Barreira near Teresópolis, ZSBS 567, March 12, 1914. Pôrto Real, BM 91.6.18.8–10 (3), du Dreneuf. Teresópolis, ZSBS 800 (2), April 1914.

***Hyla microps* Peters**

Plate 16, Figures h–j

1872. *Hyla microps* Peters, 1872a, p. 682 (type locality, Neu Friburg=Nova Friburgo, Rio de Janeiro).—Boulenger, 1882a, p. 386.—Baumann, 1912, p. 163.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 290.—Miranda-Ribeiro, 1926, p. 78.

1920. *Hyla hilli* Boulenger, p. 123 (type locality, Teresópolis, Rio de Janeiro).

Description.—Adult female, ZMB 7472 (type of *H. microps*), Nova Friburgo, Rio de Janeiro. Vomerine teeth in two long, heavy, narrowly separated, transverse patches lying between the posterior borders of the very small choanae; tongue about two-thirds the width of mouth-opening, cordiform, with a distinct notch on its free posterior border; snout short, truncate when viewed from above and in profile, the upper jaw scarcely extending beyond the lower; nostrils anterolateral, scarcely projecting, situated almost at the end of the snout. Canthus rostralis rounded but well defined because of the concave loreal region below it. Eye large and very prominent, its diameter 1⅓ times greater than its distance from end of snout; interorbital diameter equal to width of upper eyelid, equal also to width between nostrils. Tympanum distinct, a little less than one-half the eye diameter, separated from eye by an interval equal to about one-half its own diameter. Fingers almost two-thirds webbed, fourth considerably longer than second and reaching beyond base of disk of third which just covers the tympanum; no projecting rudiment of a pollex; a series of granular tubercles along outer forearm extending onto hand and outer border of fourth finger; toes short, three-fourths webbed, third and fifth subequal, disk of fourth slightly larger than that of third finger, and more than covering the tympanum; a distinct oval inner but no outer metatarsal tubercle; no true tarsal fold, instead a series of heavy round glandules on outer part of tibia, and a partial row of much smaller glandules paralleling it towards the inner part, the outer row continued along outer border of foot and onto fourth toe, giving a slightly serrate outline; a dermal fold across heel, set with small glandular tubercles, and one or two larger tubercles in the center. Head narrow, body elongate by contrast, in postaxillary region (of egg-bearing female) slightly wider than greatest width of head; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are bent at right angles to body, heels slightly overlap. Skin of upper parts smooth, except for a few small glandular tubercles on top of head; a rather weak glandular ridge dotted with pustules encircling upper border of tympanum and ending diagonally behind it. Skin of chin and chest weakly granular, that of belly, posterior femur and postanal region coarsely granular. Axillary and inguinal membrane unusually prominent. Traces of a slight skinfold across chest. This specimen, a female, is greatly distended with eggs. (The male appears to have a very large median vocal sac apparently inflatable laterally as far as the tympanum.

Dimensions.—Head and body 31 mm.; head length 8 mm., width 8 mm.; femur 13 mm.; tibia 15 mm.; hind leg 42 mm.; foreleg 19 mm.

Color in alcohol.—Ground color light fawn above, lightening to pale cream-buff on the sides; a wide, dark-bordered, sepia interorbital mark; canthus rostralis with a sepia stripe and a few dark spots on upper side of snout; a diagonal sepia bar across lip in front of eye; upper lip pale cream with a small sepia spot on edge of lip just below eye; a dark sepia stripe below tympanum fading out on shoulder; anterior part of back and sides mottled irregularly with sepia; some irregular vertical clove-brown markings very prominent in axilla and groin, which regions were probably red or orange in life; a pair of large, dull, dark spots on dorsolateral region, the first at midbody, the second near beginning of sacral region; anterior and posterior femoral surfaces pale, immaculate (probably red in life), with a very dark >-shaped clove-brown mark terminating this red area on the posterior proximal surface of femur; a narrow band of the ground tone extending along upper part of femur, crossed by pale sepia bars, its posterior edge demarked with a dark line, partly broken up, which leads into the most dorsal part of the >-shaped dark mark; tibia, foot, and forearm with wide sepia crossbands narrowly outlined with dark; two or three clove-brown spots on posterior surface of upper arm; elbow and heel with darker sepia patches; ventral surface immaculate cream-buff, except for sepia suffusions on hands and feet.

Variations.—None of the Santa Catarina specimens has so narrow a head in proportion to the postaxillary width as does the female type specimen. Some of them have small tubercles on the posterior part of the back in addition to those on the head. Some have a much darker and more prominent color pattern than that described for the type; in these the dark dorsolateral blotches are continued, narrowing on the sides and widening at the lateroventral margin, and are set off by the light (red in life) areas between them; these examples show a suffusion of dark brown on the loose skin at the sides of the throat and a few dark spots on the belly. The demarcation of dark and light is very sharp on the outer and inner limb surfaces and the appearance of the living frog must have been very striking as to color pattern.

The postfemoral pattern of the two larger frogs from Bonito is practically identical with that of the type; the young ones, in poor condition, fail to show the dark longitudinal stripe that separates the immaculate postfemoral tone from the upper femoral pattern. Instead, a narrow, usually spotted area like the skin of the body appears along the femur. The dark axillary spot, very prominent in the three larger frogs, is found in only two of the younger ones. In the two best preserved specimens, the tarsal ridge and heel tubercles are quite apparent, as are the tubercles on the back. All these specimens have a conspicuous white area below the eye on the upper lip extending below the tympanum almost to the shoulder. A few very minute dark dots occur on the edge of the upper lip, but this area is definitely less mottled than it is in the examples of *senicula*.

Structural features do not vary much in the specimens at hand. In one specimen, the knee and elbow meet when limbs are laid along the sides. The heel of the adpressed hind leg may reach to the posterior or to the anterior corner of the eye. Only the best preserved show the pustular tarsal ridge.

Remarks.—This species appears to differ from its close allies, the forms of *H. marmorata*, in the very distinctive color pattern, which inevitably displays the light area below the eye, and the immaculate postfemoral area set off by the peculiar >- or ↄ-shaped dark blotches on each side of the postanal region. The heavy, dark dorsal pattern and the prominent dark spots in the inguinal region, as well as the small tubercles on top of the head, faintly suggest *H. catharinae* Boulenger, but the other characteristics of structure and pattern are so utterly dissimilar that there can be no confusion when accurately identified examples of both species are laid side by side.

Suspecting that *Hyla hilli* Boulenger, from near Teresópolis, was synonymous with *Hyla microps,* from Nova Friburgo, a short distance to the northeast in the same mountain range, I sent photographs of the type of *microps* to the British Museum (Natural History) for comparison. Under date of December 17, 1936, H. W. Parker writes, "I have compared the photographs of the type of *Hyla microps* with the type of *Hyla hilli* and feel convinced of their identity; in fact the photographs might almost be those of Boulenger's species."

Specimens examined

BRAZIL:

Espírito Santo: Rio Novo, NHMH 2814 (4), Erhardt, 1918–19.

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96595–96600, 96708–9, 96711, A. Lutz. Nova Friburgo ZMB 7472 (type of *H. microps*). Teresópolis, BM 1914.3.20.9 (type of *H. hilli*), Hill.

Santa Catarina: Humboldt, USNM 66567–9, Fritsche, November 1918; USNM 101451–2; MZUM 58515 (7); ZSBS 67/1925, Erhardt. Itapocú, Jaraguá, NHMH 2604, Erhardt, January–March 1907. Lages, BM 88.2.7.23–25 (4), Michaelis. Rio Humboldt, BM 1923.6.1.92–99, Fritsche. Teresópolis, NHMH 1825, Werner, 1916.

8. *geographica*—group

The frogs of the *geographica* group are at once recognizable among other Brazilian hylids by their extremely attenuate limbs. The upper arm, in particular, is unusually slender, and the tibia is narrow, its width measuring but a small fraction (about one-eighth) of its length, hence the contrast is striking between this and the *rubra* group, in which the great width of the tibia is perhaps the best group character.

As members of these attenuate species apparently are not numerous anywhere, only 24 adult individuals of the Rio de Janeiro subspecies *punctatissima* having as yet come to my attention, extensive comparisons have not been practicable. The character distinguishing the two subspecies, according to Parker (1933, p. 10), seems to be the degree of webbing of the fingers, which in typical *geographica geographica* from Trinidad, Ecuador, and Perú are two-thirds webbed, whereas the southern subspecies *geographica punctatissima* from Brazil and Bolivia show a web only one-half the length of the fingers. In most of the Rio de Janeiran frogs I have examined, the web seems even less than one-half the finger length.

Hyla geographica punctatissima (Reinhardt and Lütken)

Plate 16, Figures k, l

1862. *Hylella punctatissima* Reinhardt and Lütken, p. 200, pl. 4, figs. 5, 5,a (type locality, Taboleiro Grande, Minas Gerais).
1867. *Centrotelma cryptomelan* Cope, p. 204 (type locality, Bahia).—Barbour and Loveridge, 1929, p. 237.
1870. *Cophomantis punctillata* Peters, p. 651, pl. 2, fig. 4 (type locality, Santa Catarina).
1873. *Hyla punctatissima* Peters, 1873a, p. 211.—Boulenger, 1882a, p. 359.—Baumann, 1912, p. 163.—Nieden, 1923, p. 286.—Miranda-Ribeiro, 1926, p. 87, fig. 50.
1882. *Hyla cryptomelas* Boulenger, 1882a, p. 350; 1898a, p. 132.—Baumann, 1912, p. 163.—Nieden, 1923, p. 302.—Miranda-Ribeiro, 1926, p. 89, fig. 51.—Andersson, 1945, p. 68.
1922. *Hyla geographica* L. Müller, p. 170.—Mertens, 1950, pp. 174, 184, fig. 7.
1929. *Hyla cryptomelan* Barbour and Loveridge, p. 278.
1933. *Hyla punctatissima punctatissima* Parker, p. 11.
1935. *Hyla geographica punctatissima* Parker, p. 512.

Description.—Adult male, USNM 97719, Colomi, near Teresópolis, Rio de Janeiro. Vomerine teeth in two long, heavy, anteriorly converging /‾‾\-shaped series almost meeting in the center, partly lying between and partly extending behind the very large choanae; tongue about two-thirds as wide as mouth-opening, broadly cordiform, slightly notched on its partially free posterior border; snout elongate but rather blunt at the extreme tip when viewed from above, truncate and sloping in profile; the upper jaw scarcely projecting beyond the lower; nostrils superolateral, scarcely projecting, their distance from end of snout about two-fifths that from eye, separated from each other by an interval equal to about one-half their distance from eye. Canthus rostralis sharp and very well defined; loreal region slightly concave, sloping moderately. Eye large and very prominent, its diameter equal to its distance from nostril; interorbital diameter twice as wide as the very narrow upper eyelid, and almost 2½ times the distance between the nostrils. Tympanum large, very prominent, about three-fourths the diameter of eye, separated from eye by an interval equal to about one-half its own diameter. Fingers one-third webbed, fourth much longer than second, reaching to base of disk of third which covers about one-fourth the tympanic area; no pronounced rudiment of a pollex but a very thin projecting rounded area at base of first finger; toes three-fourths webbed, fifth slightly longer than third, disk of fourth covering a little less than one-fourth the tympanic area; a very weak inner metatarsal tubercle, produced at the side rather than on the sole of the foot; no outer metatarsal tubercle; a very faint ridge along inside of tarsus; a triangular dermal appendage on heel. Body rather elongate, wide anteriorly but tapering greatly towards the groin, in the postaxillary region considerably less than greatest diameter of head; limbs exceedingly slender, femur and humerus, especially, appearing attenuate and without muscular development; when hind leg is adpressed, heel reaches tip of snout; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels just touch. Skin of upper parts smooth; a faint glandular ridge encircling upper part of tympanum and dropping down sharply behind it to end in front of the shoulder; a similar faint glandular ridge along the loreal region from nostril to eye; skin of throat and chest smooth, that of belly and lower part of thighs granular; no apparent skinfold across the chest. Apparently an internal median vocal sac.

Dimensions.—Head and body 49 mm.; head length 18 mm., width 18 mm.; femur 24 mm.; tibia 24 mm.; foot 17 mm.; hand 12 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	24	24	24	24	23	23
Mean	34. 9	36. 1	48. 0	49. 9	36. 0	28. 3
Standard deviation	1. 11	1. 73	2. 17	1. 93	1. 39	1. 17
Variation	3. 2	4. 8	4. 5	3. 9	3. 9	4. 1
Standard error	. 23	. 35	. 44	. 39	. 29	. 24
Range	32. 9– 37. 5	31. 5– 38. 3	41. 0– 51. 2	43. 8– 53. 0	32. 9– 38. 2	25. 3– 30. 9

Color in alcohol.—Fawn color above, slightly mottled, lightening to ecru-drab on sides of body and head; a dark, seal-brown, median line starting at the tip of the snout and fading out behind the occiput; sides from axilla to groin with a great number of vertical, wavy, threadlike dark markings which anastomose more or less dorsally, and lighten and merge with the fawn dorsal coloration. Limbs with irregular wide brown bands, rather indistinct above, but darkening and ending in little threadlike marks on the anterior part of femur and posterior part of tibia. Ventral surfaces pale olive-buff, immaculate.

Variations.—In a small series of adult and partly grown specimens a great variation is to be seen in the length of the leg. In two or three the heel reaches easily to the tip of the snout when adpressed, and there is corresponding length of tibia and femur in relation to body length, when compared to the other specimens in which the heel only reaches the anterior eye or nostril. Another difference is in relative size of finger disks compared to tympanum. In four specimens, including the described example, the finger disks (even when not dried accidently) are very small, covering about one-fourth the tympanic area. Two of the frogs have much larger, rounder disks, obscuring at least one-half the tympanum when applied to it. The toe-disks do not appear to vary so much. The type of *Centrotelma cryptomelan*, MCZ 1530, has the fingers two-thirds webbed, hence the webs are larger than in the one described.

The pattern is not identical in four individuals, from Colomi, near Teresópolis, in which it is still retained. One, USNM 97720, differs from the described specimen in having a dark brown arrow-shaped marking in the center of the back, with a diagonal brown line from the anteriorly pointing tip of the arrow to the posterior upper eyelid. Across the sacral region is a brown band invaded on one side by irregular dark-edged white spots. The femur has about a dozen black, wavy, parallel lines on its anterior and posterior surface, these being much more definite than on any of the other specimens. This one lacks the dark median stripe on top of the head. A smaller frog, USNM 97722, is practically without pattern of any kind, except for some faint cloudy marblings on the sides, and a trace of a dark suffusion along posterior side of femur.

Remarks.—The frogs from Colomi were kept alive for some time. They were very sluggish by day, and when handled would assume a wooden, dead appearance, with the limbs brought close to the body and the head bent forward, so that they resembled an old fungus or chip of wood. They could be left on their backs for a long time in this condition, and would continue to play dead even when undisturbed. At night they climbed slowly around the plants in the vivarium, but were not seen to take food, though ants' eggs and various kinds of insect larvae were offered. The time of year (April and May) may have had something to do with their refusal of food and general sluggishness, as it was then the beginning of winter.

The adequate discussions of this perplexing subspecies by Parker (1933, p. 10; 1935, p. 512), have defined its status quite clearly. While it is notably subject to great variation in color and even in limb proportion, the very thin legs and arms, the heel tubercle, and the prominent angular head make it a relatively easy form to identify.

Specimens examined

BRAZIL:

Bahia: Bahia, ZMB 7505 (cotype of *Cophomantis punctillata*), Wucherer; MP 331, 365 (3).

Districto Federal: Jacarépaguá, USNM 96386. Palmeiras, USNM 81122–3, A. Lutz, Sept. 23, 1923. Rio de Janeiro, Corcovado, USNM 123573–4, B. Lutz, December 1928; USNM 96392–6.

Minas Gerais: Taboleiro Grande, UZMK 46 (type of *Hylella punctatissima*), Reinhardt.

Rio de Janeiro: Colomi, near Teresópolis, USNM 97719–22, Sandig, Apr. 10, 1935. Fazenda do Cachoeira, UZMK 261–2, 1892. Ipiabas, USNM 97215–6, Mar. 8, 1925.

Santa Catarina: MP 786. Humboldt, USNM 66556–8, Fritsche, November 1918; ZSBS 68/1925 (4), Erhardt, November 1919. Itapocú, ZSBS 45, Unlauff.

São Paulo: Juquiá, 8 km. north of, MZUM 104190 (2), Bailey, 1941. São Paulo, ZSBS 20/1914, Weicke, 1913.

9. *aurantiaca*—group

The frogs of this group, represented in southeastern Brazil by *aurantiaca orophila* and *aurantiaca planicola*, are unlike other hylids in several respects, one of which is the highly peculiar body form and angular head. The translucent waxy-green texture of the living animal disappears in the preserved specimen, which changes at once to an opaque creamy white tint, the body assuming a cramped, semicircular shape apparently due to some contraction of body muscles that does not occur often when preserving hylids of other groups. The anal skin flaps, well developed in the three smooth-skinned forms of *aurantiaca*, are not like the dermal serrations found in the anal and postanal regions of *crepitans* and a few other frogs of this family.

The forms from southeastern Brazil are separated by the following key:

a^{1}. Adult size 30 to 35 mm.; femur and foot shorter (femur 41 to 45, foot 41 to 43 percent of total length . . . . **aurantiaca orophila** (p. 184)

a^{2}. Adult size 21 to 26.5 mm.; femur and foot longer (femur 45 to 47, foot 43 to 45 percent of total length) . . . . **aurantiaca planicola** (p. 186)

Hyla aurantiaca orophila Lutz and Lutz

Plate 17, Figures e–j

1895. *Hyla parvula* Boulenger (part), 1895a, p. 646 (specimen from Teresópolis, Rio de Janeiro).

1912. *Hyla aurantiaca* (not of Daudin) Baumann, p. 163.—Miranda-Ribeiro, 1926, p. 70 (part).

1938. *Hyla* (*Sphoenohyla*) *orophila* Lutz and Lutz, p. 178 (type locality, Serra do Mar, 4 km. from Petrópolis; found also at Nova Friburgo, and Serra da Bocaina at the Rio de Janeiro–São Paulo boundary).

Description.—Adult male, USNM 96692, Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two elongate, nearly transverse, narrowly separated patches between and extending to slightly behind the posterior borders of the choanae; tongue more than one-half the width of mouth opening, posteriorly almost entirely attached, cordiform and deeply notched, anteriorly truncate like lower lip border, which is squarely cut off; snout moderate in length, angularly /‾‾\-shaped when viewed from above, rounded and projecting greatly beyond the lower jaw in profile; nostrils superolateral, not projecting, nearly at the tip of the snout, separated from each other by an interval only slightly less than their distance from eye. Canthus rostralis not clearly defined; loreal region vertical, flat. Eye moderate in size, fairly prominent, its diameter equal to its distance from end of snout; interorbital diameter about 1½ times the width of upper eyelid and 1½ times the distance between nostrils. Tympanum distinct, a little less than one-half the eye diameter, separated from eye by an interval equal to one-half its own diameter. Fingers one-third webbed, fourth much longer than second and extending to base of disk of third, which covers three-fourths of the tympanum; a distinct rudiment of a pollex visible; toes nearly three-fourths webbed, third shorter than fifth, disk of fourth as large as that of third finger and likewise covering about three-fourths of the tympanum; a larger inner and a very small, weak, outer metatarsal tubercle, a heavy skinfold across heel, but no true dermal appendage; a slight glandular ridge along outer surface of tarsus, but none on inner border. Body rather elongate, in postaxillary region slightly wider than head. When hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to the body, heels considerably overlap. Skin of upper parts very finely shagreened; tympanic ridges scarcely apparent; skin of throat and belly coarsely shagreened, that of vocal pouch very minutely so; a skinfold across throat, followed by the vocal pouch which, when deflated, forms eight longitudinal folds, the outermost of which extends into the axilla.

Dimensions.—Head and body 31 mm.; head length 9 mm., width 9 mm.; femur 13 mm.; tibia 15 mm.; foot 13 mm.; hand 8.5 mm.

Mathematical analysis (in percentages of the total length):

	head length	head width	femur	tibia	foot	hand
Number	5	5	5	5	5	5
Mean	28.3	28.6	43.0	48.1	42.4	28.0
Standard deviation	2.35	2.39	2.17	2.97	1.16	1.20
Variation	8.3	8.4	5.0	6.2	2.7	4.3
Standard error	1.05	1.08	.98	1.33	.52	.54
Range	27.2– 30.0	27.2– 30.0	41.9– 44.1	46.7– 50.0	41.9– 43.3	27.4– 28.8

Color in alcohol.—Immaculate pinkish buff above and below, the veins of the legs showing through the translucent skin.

Remarks.—The muscular contraction after death of the head and fore part of the body is not nearly so pronounced in this form as in *planicola.* The adpressed heel reaches only to the posterior corner of the eye in three, and to the center of the eye in one specimen. USNM 96693 has a distinct dorsal pattern of dark elongate spots on the back, and an irregular X-shaped mark between the eyes, while two of the remaining specimens show pale traces of this pattern.

In the small series available, I find a significant difference in the length of the femur, this member being shorter in *orophila* than in either *planicola* or northern *aurantiaca*. The apparently greater adult size of *orophila*, and its more or less distinct dorsal pattern differentiate it from the smaller, entirely immaculate *orophila*.

The degree of webbing on hands and feet, the shape of the snout and the position of the vomerine teeth are very similar in the two subspecies, and are subject to about the same degree of variation.

Boulenger's cotypes of *H. parvula* from Lagos, Santa Catarina, belong to the genus *Cochranella* (Taylor and Cochran, 1953, 1628). A third cotype, from Teresópolis, Rio de Janeiro, appears to be a young *orophila*.

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96692–6, A. Lutz, 1925. Nova Friburgo, ZMB 73–2463 (2). Teresópolis, BM 95.3.6.5, Goeldi.

Hyla aurantiaca planicola Lutz and Lutz

Plate 17, Figures c, d

1912. *Hyla aurantiaca* (not of Daudin) Baumann (part), p. 163.—Miranda-Ribeiro (part), 1926, p. 70.

1938. *Hyla* (*Sphenohyla*) *planicola* Lutz and Lutz, p. 182, figs. 3–5 (type locality, Recreio dos Bandeirantes, also Baixada Fluminense, Districto Federal).

1946. *Hyla planicola* Myers, pp. 12, 30.

Description.—Adult female, USNM 97619, Recreio dos Bandeirantes. Vomerine teeth in two short, narrowly separated, posteriorly converging groups considerably behind the posterior borders of the choanae; tongue three-fourths as wide as the mouth-opening, posteriorly cordiform and very deeply notched, anteriorly transversely truncate to correspond with the anterior border of the lower lip, which is squarely cut off and not rounded; snout moderate in length, angularly /‾\-shaped when viewed from above, truncate and declivous in profile, the snout projecting very considerably beyond the lower jaw; nostrils lateral, not projecting, their distance from end of snout about one-fifth that to anterior border of eye, separated from each other by an interval equal to about three-fourths their distance from eye. Canthus rostralis not very well defined; loreal region vertical, flat. Eye moderate, not very prominent, its diameter slightly less than its distance from end of snout; interorbital diameter about 1½ times the width of upper eyelid, almost 2 times the distance between nostrils. Tympanum distinct except at its upper border where it is somewhat obscured by the very finely glandular skin of the upper parts, about one-half the diameter of the eye, separated from the eye by a distance equal to one-half its own diameter. Fingers one-third webbed, fourth appreciably longer than second and extending almost to disk of third, which nearly covers the tympanic area; a very pronounced rudiment of a pollex visible; toes three-fourths webbed, third and fifth subequal, disk of fourth as large as that of third finger and also nearly covering the tympanum; a distinct projecting tubercle at base of first toe, but no apparent outer metatarsal tubercle; no dermal appendage on heel; no inner tarsal ridge; a distinct glandular outer tarsal ridge which extends over the heel almost as an appendage and ends on the femur; body rather elongate, in the postaxillary region about equal to the greatest width of head; when hind leg is adpressed, heel reaches anterior corner of eye; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts very finely glandular, the flesh beneath it almost waxlike in consistency; no glandular ridges above the tympanum; skin of throat and chest very finely glandular with minute pustules scattered over it; skin of belly and lower surface of femur finely granular; a skinfold across the chest. (An external vocal sac in the male.)

Dimensions.—Head and body 24 mm.; head length 7 mm., width 7 mm.; femur 11 mm.; tibia 12 mm.; foot 10.5 mm.; hand 7 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	10	10	10	10	10	10
Mean	29. 1	29. 9	46. 2	50. 0	44. 1	28. 8
Standard deviation	1. 42	2. 72	1. 48	1. 34	1. 25	1. 22
Variation	4. 9	9. 1	4. 8	2. 7	2. 8	4. 2
Standard error	. 45	. 86	. 47	. 42	. 40	. 39
Range	26. 4–31. 1	28. 3–31. 1	43. 5–47. 8	47. 8–52. 1	42. 2–45. 7	26. 7–30. 6

Color in alcohol.—A few days after preservation, this and the other specimens faded to an immaculate pearly olive-buff above and below, with a suffusion of buff on the belly and lower femur. A very close inspection of the dorsal skin under the microscope reveals some scattered groups of very minute vinaceous dots which give the slightest suggestion of pale pinkish spots when observed closely by the unaided eye.

Color in life.—A few days after capture, the following color notes were taken on the living specimens: Color of back between emerald and apple green, very intense. Legs and arms above much paler, waxlike, pea green to pale paris green, this green reduced on the thighs to a narrow, median, punctulated line. Ventral surface pale malachite green, the peritoneum opaque white, the rest of the skin translucent. Finger tips olive-yellow. Bones perfectly visible through the flesh. Iris orange-rufous in center, mixed with gray and oil green at periphera, sometimes brassy. Pupil very narrow, edged with white, notched above and below. Tympanum not at all visible in life, covered by skin of the same color and texture as that on the rest of the head. Its waxy appearance is very striking.

Variations.—Some individuals show a less squarely transverse termination of the lower lip. All, however, have the snout peculiarly unlike other hylids, and the heavy vomerine teeth behind the posterior level of the choanae. The large air-sacs on the sides of the body and the extremely distensible throat sacs are still to be seen in some of the preserved examples. The lack of color pattern is evident in the entire preserved series.

Remarks.—A peculiar muscular contraction after death causes all the specimens to assume a curiously bent and cramped position that makes it difficult to straighten them out so that their true proportions can be observed. The unusual waxy quality of the flesh is clearly apparent even after several months of preservation in alcohol.

The length of the upper arm is another interesting feature of this species. In few frogs do the limbs more than touch the knee and elbow when they are normally placed against the sides of the body, but in this species the overlapping is conspicuous.

The frogs of this species were all caught at night in the stagnant water of a swamp. The male floats while calling for the females. At this time the frog can be lifted out of the water on the open palm of the hand and transferred to the collecting bag without closing the fingers.

The mating call begins with a *tang*, followed by a chirping like a cicada. In calling, the vocal sac gets so large that the rest of the small body almost disappears behind it.

Specimens examined

BRAZIL:

Districto Federal: Recreio dos Bandeirantes, USNM 97619–21, B. Lutz, Cochran, and Venancio, February 1935. Swamp at Km. 40 on road to São Paulo, USNM 97563–9, A. Lutz, Cochran, and Venancio, Feb. 20, 1935.

10. *anceps*—group

This unusual hylid *anceps* at present has no known close relatives in the genus in southeastern Brazil.

Hyla anceps **A. Lutz**

Plate 17, Figures a, b

1929. *Hyla anceps* A. Lutz, 1929b, p. 943 (type locality, Estrella, Districto Federal).—Myers, 1946, pp. 15, 30.

Description.—Adult male, USNM 96441 (cotype), Estrella, Rio de Janeiro. Vomerine teeth in two very heavy, short, narrowly separated, transverse patches lying between the posterior borders of the choanae; tongue three-fourths as wide as mouth-opening, cordiform, deeply notched and free behind; snout moderate in length, obtusely angulate when viewed from above, rounded in profile, the upper jaw projecting somewhat beyond the lower; nostrils superolateral, projecting, their distance from end of snout about half that from anterior border of eye, separated from each other by an interval about equal to their distance from eye. Canthus rostralis rather well defined; loreal region slightly concave. Eye moderate, not excessively prominent, its diameter slightly greater than its distance from nostril; interorbital diameter about equal to the width of upper eyelid, greater than space between nostrils. Tympanum very distinct, about one-half the diameter of the eye, separated from eye by a distance nearly equal to its own diameter. Fingers one-half webbed, fourth considerably longer than second, disk of third finger slightly exceeds the tympanic area; no rudiment of a pollex visible; toes three-fourths webbed; third slightly longer than fifth, disk of third toe practically equals the tympanic area; a distinct projecting inner tubercle at base of first toe, but no apparent outer metatarsal tubercle; body rather short and broad, in the postaxillary region slightly exceeding the greatest diameter of head; when hind leg is adpressed, heel reaches to nostril; a heavy glandular ridge produced into a pair of distinct tubercles on the heel, but no true dermal appendage; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to the body, heels greatly overlap. Skin of upper parts apparently smooth but with several transverse or irregularly chevron-shaped glandular ridges beginning across the snout and continuing across the back and on femur and tibia, some of these ridges more pronounced than others, but all accentuated with light pigment; a few scattered pustules between these ridges on the back, becoming more accentuated and lightly pigmented posteriorly; a heavy, wide glandular ridge from eye above tympanum, ending above the shoulder; skin of chin and throat very finely pustular, that of chest, belly, posterior femur and anal region very heavily granular; a very strong skinfold across the chest. A prominent external median vocal sac.

Dimensions.—Head and body 40 mm.; head length 12.5 mm., width 13 mm.; femur 19.5 mm.; tibia 20 mm.; foot 16.5 mm.; hand 12 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	6	6	6	6	6	6
Mean	34. 2	34. 4	47. 0	52. 7	43. 5	30. 8
Standard deviation	1. 64	1. 60	1. 50	1. 66	1. 29	. 47
Variation	4. 8	4. 7	3. 2	3. 2	3. 0	1. 5
Standard error	. 62	. 61	. 57	. 63	. 48	. 18
Range	31. 6– 37. 0	32. 5– 37. 0	44. 8– 48. 2	50. 0– 55. 5	41. 2– 44. 8	30. 0– 31. 5

Color in alcohol.—Upper parts cream-buff to ecru-drab, with numerous triangular and chevron-shaped markings (between the glandular ridges) drab to deep fawn color, their margins (glands) narrow and very pale in color; the upper parts of arms and legs similarly cross-banded but the bands on the femur very dark brown, with a continuation of the dark brown color upon the groin, and on the posterior lateral region appearing as roundish light-edged spots. A similar postaxillary brown spot. Canthus rostralis narrowly edged by a light-pigmented gland; below this the loreal region, upper lip, and entire side of head and body to axilla are deep drab, immaculate. Ventral surfaces (now badly faded) pale ecru-drab, darker on the legs. A dark anal patch.

Color in life.—From a color sketch by R. Honorio, no data given. Upper parts of head, back, forearm, tibia, and outer foot cinnamon, with a series of transverse or chevron-shaped areas surrounded by narrow light lines, the first of these on the snout, the next between the eyes, and about six following on the back, more or less irregular and broken up, those on the tibia narrow and regular, those on forearm and foot wide and far apart; femur pale cinnamon, with three wide, white-edged black bands nearly encircling it; a series of similar light-edged black spots along the sides from axilla to groin, and another series along inside of tarsus and foot; a wide black band beginning on the tip of the snout, continuing along the loreal region and ending behind the axilla as the first lateral spot; posterior part of forearm, webs of fingers and toes, as well as inside of tarsus bright orange-rufous; ventral surfaces also orange-rufous, the chin dark olive, with an olive reticulation over chest, belly, and lower side of forearms; the heavy black bands partly encircling lower femur and entirely complete on tibia. Iris rufous, the black pupil transversely elliptic.

Variations.—In USNM 97559 one of the two tubercles on the heel is developed to such an extent that it projects considerably beyond the normal outline of the leg, and begins to resemble a true dermal appendage. The color pattern of dark chevrons edged by light glandular ridges remains constant throughout the rather small series at hand, although the ground color of the upper parts varies from a very pale pea green to walnut brown, while the side of the head in the darkest individual is a deep seal brown. In all the recently preserved specimens, the femoral crossbands are a deep clove brown, while the inguinal and axillary spots are likewise of this shade. In these relatively fresh examples, the chin is dark, ranging from mouse gray to seal brown, while the loose skin of the vocal pouch is paler in two of the specimens. The belly shows a fine, brown, reticulated pattern; the lower part of the thighs shows the subdued remnants of the crossbands; one or two dark but ill-defined longitudinal stripes leave the brown postanal area and run halfway to the knee; the lower parts of tibia and tarsus also show remnants of the dark crossbands; and the toes (above and below) are dark, the webs between them being very light.

Remarks.—The voice is much like that of *Hyla albomarginata*, consisting of a repeated *creck-creck-creck* or a strong, rather hoarse *cran, cran, cran, c-r-r-en, c-r-r-en.* Adults are found at night in stagnant water and on bulrushes (*taboas*) where there is no arboreal vegetation, in swamps of the seaboard plain of the State of Rio De Janeiro. The eggs and young are not yet known, and the species appears to be quite rare, although it has been taken in several different places.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, USNM 81102, A. Lutz, 1930. Surupuhy, USNM 97399–97400, Cochran, Dias, and Venancio, Mar. 6, 1935. Swamp at Km. 40 on road to São Paulo, USNM 97559–60, A. Lutz, Cochran, and Venancio, Feb. 20, 1935.

Rio de Janeiro: Estrella, USNM 96441–2 (cotypes of *H. anceps*), A. Lutz, Jan. 3, 1929.

11. *goeldii*—group

The species *goeldii* stands alone among hylids in having a dorsal brood pouch for eggs in the female. It may be a link with *Nototheca fissilis* and with the Gastrothecas, but the internal anatomy of all the pouch-bearing forms will have to be studied in great detail before their true relationships can be accurately stated.

***Hyla goeldii* Boulenger**

Plate 18, Figures a–h

1895. *Hyla goeldii* Boulenger, 1895a, p. 645, pl. 40, fig. 2 (type locality, Colonia Alpina, Teresópolis, Rio de Janeiro); 1895b, p. 209, pl. 10, figs. 1–3.—Goeldi, 1895, p. 94, fig. 2.—Gadow, 1901, p. 198.—Brandes and Schoenichen, 1901, p. 404.—Baumann, 1912, p. 163.—Mertens, 1930, p. 162.—Mello-Leitão, 1937, pp. 141–2, fig. 28.—Myers and Carvalho, 1945, p. 17.—Myers, 1946, pp. 14, 31.—B. Lutz, 1947, p. 245, pl. 1.

1907. *Hyla ohausi* Wandolleck, p. 4, pl. 1, figs. 8–8,b (type locality, Petrópolis, Rio de Janeiro).—Baumann, 1912, p. 163.—Nieden, 1923, p. 298.—L. Müller, 1924b, p. 235.—B. Lutz, 1947, p. 246; 1949a, p. 4.

1920. *Fritzia goeldi* Miranda-Ribeiro, 1920g, p. 321.

1920. *Fritzia hohausi* Miranda-Ribeiro, 1920g, p. 327.

1926. *Fritzia göldii* Miranda-Ribeiro, p. 107, fig. 63.

1926. *Fritzia ohausi* Miranda-Ribeiro, p. 107.

1937. *Fritziana goeldii* Mello-Leitão, p. 330.

Description.—Adult male, USNM 96665, Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two short, rather weak, transverse series narrowly separated medially behind the very small choanae; tongue about three-fourths as wide as mouth-opening, very broadly cordiform and deeply notched on its free posterior border; snout very short but with a median tubercle which gives it a sharp point when viewed from above, rather truncate in profile, the upper jaw projecting only slightly beyond lower; nostrils superolateral, scarcely projecting, almost at the tip of the snout, appearing very close together but in reality separated from each other by an interval equal to nearly one-half their distance from eye. Canthus rostralis well defined; loreal region flat, set off from upper lip by a distinct shallow groove. Eye rather large, prominent, its diameter equal to its distance from nostril; interorbital diameter almost twice that of upper eyelid, which is very narrow, and more than twice that between the nostrils. Tympanum not very distinct, covered with skin like the surrounding area, about one-half the diameter of eye, separated from eye by an interval equal to its own diameter. Fingers webbed only at the base, fourth extending to base of disk of third which covers the tympanic area, second extremely short, only slightly longer than first; no projecting rudiment of pollex; toes webbed only at the base, third slightly shorter than fifth, disk of fourth toe nearly covering tympanic area; a distinct, projecting inner but no outer metatarsal tubercle; apparently no inner or outer tarsal ridge; no dermal appendage on heel; body not elongate, in the postaxillary region about equal to greatest diameter of head; when hind leg is adpressed, heel reaches to posterior corner of eye; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts quite smooth except for some indistinct tubercles on snout; a pronounced broad glandular ridge extending from eye over upper border of tympanum and partly obscuring the latter; skin of throat and chest smooth, of belly faintly granular, of thighs rather coarsely granular; no apparent skinfold across the chest. A prominent external median vocal sac.

Dimensions.—Head and body 32.5 mm.; head length 11 mm., width 11 mm.; femur 12.5 mm.; tibia 15.5 mm.; foot 13.5 mm.; hand 8.5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	19	19	19	19	19	19
Mean	33. 9	34. 8	46. 1	51. 6	45. 7	29. 5
Standard Deviation	1. 97	1. 94	3. 85	3. 86	3. 51	2. 36
Variation	5. 8	5. 6	8. 3	7. 5	7. 2	8. 0
Standard error	. 45	. 45	. 88	. 89	. 81	. 54
Range	31. 3–38. 0	31. 2–38. 6	38. 4–50. 0	45. 8–60. 0	37. 8–49. 1	24. 6–34. 8

Color in alcohol.—Dorsum pinkish buff, becoming lighter in a chevron-shaped patch between eyes and on top of snout; in front of this patch a wavy slate-gray line from nostril to eye along canthus rostralis, and below it another slate-gray line from tip of snout to lower eyelid, slightly less regular in outline; back with numerous olive spots and reticulations which are heavier on the postaxillary region, lighter between the insertion of the arms, and heavier again between the eyes just posterior to the light chevron-shaped interocular patch; femur without crossbars, immaculate posteriorly, with a few light olive spots anteriorly; tibia, foot, and forearm also with pale light olive spots; disks of toes and fingers olive above, paler below; ventral surface immaculate pinkish buff.

Color in life.—From a color sketch by Pugas of a female with eggs, USNM 96674, from Bonito. Dorsum pale pinkish buff, deepening to buff on eyelids and top of head; canthus rostralis and loreal region seal brown; a heavy Y-shaped seal-brown marking extending from behind the eyes, its posterior part lightening to olive, bordered by a white stripe, then by a sepia stripe seeming to conform with the glandular supratympanic ridge, then by another pale stripe below this. Many fine sepia dots all over back and sides, especially concentrating to form pale crossbands on tibia and forearm and darkening the toe and finger disks. Iris apparently yellow ochre.

Variations.—Some newly metamorphosed young from the same series measure 10 mm. in total length. The dark reticulation on the back of adults is often rather prominent, as is also the characteristic pale interocular bar, often with a contrasting dark horseshoe-shaped figure following it. The dark canthal stripe is distinct in some and nearly absent in others. Vomerine teeth may be between the posterior borders of the choanae, or actually behind this level. A number of adult females without eggs show the skin of the dorsolateral region very loose and apparently stretched, so that it can be inflated almost like one of the vocal vesicles.

Remarks.—The female carries on the sides under a fine but distinctly pigmented membrane about nine large eggs which become dark when the tadpoles begin to develop. The latter are born with the posterior extremities already free and develop generally in the water of bromeliads, where the frog was found in Tijuca.

The eyes, directed forward, may be very prominent; the pupil is oval, the iris bronzy with black vermiculations. A glandular fold runs back from the small tympanum, covering its upper border.

Young individuals are recognized by the light frontal and superorbital spot, which may disappear temporarily at any time.

Specimens examined

BRAZIL:

Districto Federal: Bico do Papagaio, USNM 97219. Tijuca, USNM 96242–4, A. Lutz, July 1921.

Minas Gerais: Santa Rita de Passa Quatro, USNM 96919, A. Lutz, November 1920.

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96664–91, 96705, A. and B. Lutz. Colonia Alpina, near Teresópolis, BM 94.5.23.14–15 (cotypes of *H. goeldii*), Goeldi; BM 94.5.23.16–21, 95.3.6.4. Macaé, USNM 96475, Pugas, Mar. 23, 1924. Pedra de Sertão, Serra das Orgãos, NHNP 02–378, Wagner. Petrópolis, NHMH 2624, Ohaus, Jan. 1, 1900. Serra de Friburgo, USNM 96466, A. Lutz, October 1922.

São Paulo: Alto da Serra, MP 307.

Genus *Nototheca* Bokermann

1950. *Nototheca* Bokermann, p. 217. (Genotype, *Coelonotus fissilis* Miranda-Ribeiro.)

Generic diagnosis.—A translation of Bokermann's generic diagnosis follows:

Hylidae with characteristic slender body. Eyes projecting, pupils oval. Vomerine teeth present; mandible toothless, maxillae provided with small, sharp, irregular teeth. Tongue thick and cordiform. Skin of head not adhering to skull. Omosternum and xiphisternum cartilaginous; sacral diapophysis dilated and directed backwards. Females with a dorsal incubating pouch, opening exteriorly in a bifurcate longitudinal slit.

Nototheca fissilis (Miranda-Ribeiro)

Plate 18, Figure 1

1920. *Coelonotus fissilis* Miranda-Ribeiro, 1920g, p. 324 (type locality, Serra de Macaé, Rio de Janeiro); 1926, p. 108.

1950. *Nototheca fissilis* Bokermann, p. 218, figs. 1–4, 6–8.

Description.—Since no examples of this species have been examined by me, the following translation of Bokermann's redescription of it is given:

Lectotype: Dept. Zool. No. 30 A.

General aspect slender. Head not much flattened, its width contained approximately three times in total length of body. Eyes projecting, longer than the distance which separates them from nostrils; pupil oval, transversely elongate. Tympanum very apparent, less than 1/3 the eye diameter. Canthus rostralis very evident. Nostrils small, well above the canthus rostralis, near tip of snout, which is sharp and slightly projecting. Skin of head completely free of skull.

Vomerine teeth in two series very close together between and behind the large choanae, forming an arc directed backwards. Mandibles toothless. Maxillae provided with a series of small, pointed, irregular teeth.

Tongue thick and cordiform, slightly free and notched on its posterior border.

Sternal apparatus robust; coracoids and precoracoids curved; omosternum cartilaginous, small and lanceolate in shape; xiphosternum very large, cartilaginous and spatulate with its extremity terminated by a slight but very broad notch.

Sacral diapophysis dilated and directed backwards.

Anterior limb short, not reaching to end of urostyle with tip of third finger when adpressed backwards against the body. Fingers without webs, provided with adhesive disks a little smaller than the tympanum, in the following order of size: 2,1,3,4. [His figure of the hand shows the following order of size: 2, 1, 4, 3.] Inner surface of fingers, like palm of hand, provided with a series of callosities of irregular size and shape. Posterior limb, when adpressed along the body, passing beyond eye with the heel. Toes very delicate, with adhesive disks on the tips smaller than those of fingers. The four last phalanges are united by a membrane which does not reach the distal end of the first phalanx. Toes in following order of size: 1, 2, 3, 5, 4. Sole of foot and inner surface of toes with a series of irregular callosities less evident than those on inner surface of fingers and palm of hand.

* * *

A large pouch on the back [in the female], almost double the width of abdomen, including all the upper surface from shoulders to coccyx. The opening of this pouch is median, consisting of a longitudinal slit beginning anteriorly as a Y-shaped convergence that limits a wedge of concave margins insinuated within the pouch opening. The transparent dorsal wall permits a series of 12 embryos, completely formed and measuring approximately 5 mm., to be seen clearly in the interior of the pouch. In the midline the margins of the pouch fold inside vertically, forming a double partition that does not reach to the depths of the pouch. On the inside and bottom of the pouch the dorsal skin lies in folds forming the cellules in which the embryos are lodged.

The ventral skin of the type is slightly granular on the abdomen and gular region; smooth on both surfaces of limbs and upper part of head.

Generally light straw color, much discolored by the action of light, so that no vestiges of the spots mentioned by Mirando-Ribeiro in his description of 1920 may be perceived. . . .

Measurements in millimeters of the type series:

	30A	*30B*	*30C*
Total length	29. 2	28. 0	27. 5
Head width	9. 8	9. 3	9. 0
Eye diameter	4. 0	4. 0	4. 0
Width of tympanum	1. 2	1. 2	1. 2

Bokermann reports four additional male frogs of this species from the Organ Mountains, State of Rio de Janeiro, in which the color pattern is still perceptible. The ground color of all specimens is dark yellow. In the one appearing as figure 4 in Bokermann's paper, there are two interrupted dark lines extending from the nostrils to the anal region on each side of and near to the midline. One of the others has a dark line between the eyes, and two more lines from the posterior corners of the eyes reaching to midbody.

Genus *Phyllomedusa* Wagler

1830. *Phyllomedusa* WAGLER, p. 201. (Genotype, *Hyla Bicolor* Daudin.)

Generic diagnosis.—Pupil erect. Tongue oval, extensively free behind, entire or slightly nicked. Vomerine teeth present or absent.

Fingers and toes free or slightly webbed, first opposable to the others, the tips dilated into regular disks. Outer metatarsals united. Omosternum cartilaginous; sternum cartilaginous. Diapophyses of sacral vertebra strongly dilated.

Four species of this genus are known from southeastern Brazil. When their habits are known they are not difficult to collect, as they sleep in leaf axils during daylight and descend to the ponds only at nightfall. Their movements are slow and languid compared to other Hylidae, and they allow themselves to be picked up without showing fear.

The species from southeastern Brazil are separated by the following characters:

*a*¹. First toe shorter than second; a dermal heel appendage.
  *b*¹. Eardrum quite distinct; anal region less granular . **appendiculata** (p. 196)
  *b*². Eardrum not very distinct; anal region more granular . . . **guttata** (p. 201)
*a*². First toe longer than second; no dermal heel appendage.
  *b*¹. No vomerine teeth . . . . **rohdei** (p. 204)
  *b*². Vomerine teeth present . . . . **burmeisteri** (p. 198)

For a statistical analysis of measurements of these species, see pages 373 and 379.

Phyllomedusa appendiculata A. Lutz

FRONTISPIECE; PLATE 18, FIGURES J, K

1925. *Phyllomedusa appendiculata* A. LUTZ, 1925a, p. 139 (type locality, São Bento, Santa Catarina); 1926a, pp. 8, 15.—LUTZ and LUTZ, 1939b, p. 219.

1926. *Phrynomedusa fimbriata* MIRANDA-RIBEIRO, p. 106, fig. 62 (type locality, Alto da Serra, São Paulo).

Description.—Adult male, USNM 97147 (cotype of *Phyllomedusa appendiculata*), São Bento, Santa Catarina. No vomerine teeth; tongue cordiform, one-half as wide as mouth-opening, with a very deep notch on its free posterior border; snout short, rounded when seen from above, truncate and vertical in profile, not projecting beyond lower jaw; nostrils lateral, almost at tip of snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis angular and distinct; loreal region slightly concave and somewhat diagonal. Eye large, projecting, its diameter slightly less than its distance from end of snout; interorbital diameter 1½ times the width of upper eyelid, much greater than distance between nostrils. Tympanum fairly distinct, though covered by skin, a low glandular swelling along its upper border, a distinct glandular skinfold leaving its lower posterior margin and terminating above and behind the shoulder; diameter of tympanum about two-fifths that of eye, separated from eye by an interval equal to about one-half its own diameter. No parotoid gland. Fingers moderate in length, nearly one-third webbed, first shorter than second and apparently only slightly opposable, fourth shorter than third; disk of third covering the tympanic area; base of first finger with a distinctly enlarged callosity; a distinct glandular ridge from base of fourth finger to elbow and another on top of forearm; toes one-third webbed, first shorter than second, disk of third covering the tympanic area; a distinct heavy inner but no outer metatarsal tubercle; a very faint ridge on top of tarsus, continued on outside of tibia; a heavy outer tarsal ridge beginning near disk of fifth toe, edging the heel in a large triangular dermal appendage, and continuing much reduced along inside of tibia; a very slight glandular ridge in front of anus. Body moderately elongate, the width of the head contained slightly more than 2½ times in distance from tip of snout to coccyx; when hind limbs are adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to the body, heels considerably overlap. Skin of upper parts faintly shagreened; no dorsolateral ridge; skin of throat slightly granular, that of chest, belly, and lower femur heavily granular, with some large, heavy glandules in the postanal region. No apparent skinfold across the chest. No external vocal sac. A roughened dark excrescence on callosity at base of first finger.

Dimensions.—Head and body 35 mm.; head length 11.5 mm., width 12.5 mm.; femur 16 mm.; tibia 17 mm.; foot 13 mm.; hand 10 mm. (the forearm is tremendously overdeveloped in comparison to the weak, slender upper arm, and thus it is rather difficult to extend this limb to its full length in a stiffened alcoholic specimen).

Color in alcohol.—Upper parts of head and body dull Indian purple, becoming lighter posteriorly, a sharply defined area of this same color on outer part of hand and forearm between the glandular ridges, and similar areas of color from knee to outer toe; thick skin of upper lip and side of head, including edge of upper eyelid and tympanic region, as well as sides of body, whitish cream; ventral surfaces and entire tibia pale vinaceous-pink.

Color in life.—A colored sketch of this same specimen, made by Paul Sandig probably shortly after it was preserved, shows the upper surfaces dull indigo, with the exception of the whitish cream upper arm, femur, fingers, and toes. The ventral surfaces are immaculate whitish cream.

Variations.—An adult specimen, USNM 96447, from Teresópolis, Rio de Janeiro, has the tongue scarcely emarginate posteriorly, showing how unstable is this condition in the species, since the described specimen shows a very deep notch; snout in profile slopes upward and backward from the mouth, and its vertical condition in the cotype may be the result of an injury. While the webs are almost identical in the two frogs, the disks of toes and fingers appear somewhat smaller in 96447, owing perhaps to a different mode of preservation, and the dark dorsal tone is very sharply set off from the light ventral tint, apparently not by color alone but by a difference in skin texture, as the dorsal and upper lateral regions have a thick, glandular covering, while the ventral surfaces are covered by translucent, thin skin, although this may be dotted in certain regions by heavy aggregations of granules. A light brown band leaves the posterior corner of the eye, beginning again behind the tympanum and continuing along the posttympanic skinfold to the shoulder and fading out as a series of brown dots bordering the juncture of dorsal and lateral colors on the sides. This specimen has the following measurements: head and body 37 mm.; head length 12 mm.; head width 12.5 mm.; femur 15.5 mm.; tibia 16.5 mm.; foot 13.5 mm.; hand 9.5 mm.

Remarks.—Accompanying the adult from Teresópolis are five tadpoles of various sizes and six eggs in which different developmental stages may be seen. The egg-yolk with the larva already in an advanced stage appears to be about 4 mm. in diameter, the gelatinous envelope adding another 2 or 3 mm. The smallest of the young tadpoles is 13 mm. in total length, of which head and body make up 4 mm. A highly advanced tadpole, with all four limbs well developed and the tail partly absorbed, measures 35 mm. in total length, the head and body 18 mm. The adult male is only 37 mm. in length, so that the metamorphic frog is almost half as long by actual measurement. The eggs are laid in leaves of small plants overhanging the water, about 50 to each ball of gelatin. In two or three days after laying, the tadpoles flop themselves out of the egg mass into the water. The time occupied by entire metamorphosis is not known.

The species is not common, having been found near running water first in São Bento and later in Teresópolis. Its voice is like that of *P. guttata* and is described as a long rasping sound followed by two or three clucking notes. It is closely related to *guttata*, but the two can be quite easily distinguished by the structural characters of amount of webbing and shape of snout, as well as by color pattern.

Specimens examined

BRAZIL:

Rio de Janeiro: Teresópolis, USNM 96447–8, A. Lutz, Feb. 9, 1929.

Santa Catarina: São Bento, USNM 97147 (cotype of *Ph. appendiculata*), Nahderer, February 1924.

Phyllomedusa burmeisteri **Boulenger**

Plate 19, Figures a, b

1856. *Phyllomedusa bicolor* (not of Boddaert, 1772) Burmeister, pp. 91, 111, pl. 32, figs. 1–9.—Günther, 1858, p. 120.—Cope, 1868, p. 112 (note).

1882. *Phyllomedusa burmeisteri* Boulenger, 1882a, p. 428 (type localities, Rio de Janeiro, Brazil, and Oran Salta, Buenos Aires, Argentine).—F.

Müller, 1884, p. 282.—Berg, 1896, pp. 151, 212.—Brandes and Schoenichen, 1901, p. 403, pl. 2, fig. 5.—Peracca, 1904a, p. 13.—Baumann, 1912, p. 110.—Nieden, 1923, p. 339.—Miranda-Ribeiro, 1923e, p. 3; 1926, p. 102, pl. 5, figs. 6, 6,a; 1929a, p. 67.—Cott, 1926, p. 1160.—Ahl, 1927a, p. 61.—L. Müller, 1934a, p. 166.—Lutz and Lutz, 1939b, p. 219.—Myers, 1946, pp. 14, 32.—B. Lutz, 1947, p. 244; 1949b, p. 551.

Description.—Adult female, USNM 96440, Estrella, Rio de Janeiro. Vomerine teeth in two short, heavy, posteriorly converging, widely separated series between the choanae; tongue oval, slightly more than one-third as wide as mouth-opening, with a small but distinct indentation in its very free posterior border; snout moderate in length and bluntly pointed when viewed from above, flat and sloping forwards and downwards in profile, the upper jaw not projecting beyond the lower; nostrils lateral, scarcely projecting, located almost at the tip of the snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis prominent though rounded; loreal region concave and nearly vertical. Eye moderate in size, not very prominently projecting; its diameter about three-fourths its distance from end of snout; interorbital diameter about 1⅔ times the width of upper eyelid, much greater than distance between nostrils. Tympanum distinct though covered by skin, its greatest (vertical) diameter equal to three-fifths the eye diameter, separated from the eye by an interval equal to one-half its diameter. A very heavy, low parotoid gland extending back from posterior corner of eyelid to a point about a head length from its origin where it merges abruptly with the rather glandular dorsolateral skin. Fingers long and slender, unwebbed, first shorter than second and apparently easily opposable; fourth shorter than third, disk of third covering about one-half the tympanic area; a distinct semicircular thin projection at base of first finger; a glandular ridge from base of fourth finger to elbow; toes webbed only at the base, first longer than second and opposable to it; disk of third covering about one-half the tympanic area; no inner or outer metatarsal tubercles; no tarsal ridge on inside, but a rather indistinct one beginning on outside of fifth toe, extending along tarsus and becoming much more apparent across the heel; no dermal appendage on heel; a distinct transverse glandular ridge in front of the anus. Body quite elongate, the width of head contained 3 times in distance from tip of snout to coccyx well anterior to anus; when hind leg is adpressed, heel reaches to center of tympanum; when limbs are laid along the sides, knee and elbow are separated by a considerable interval; when hind legs are bent at right angles to the body, heels slightly overlap. Skin of upper parts thick and glandular or somewhat pustular, depending on the preservation. Skin of throat and chest smooth; of belly, lower surface of thighs, forearm, tarsus, and region around anus very coarsely granular. Apparently no skinfold across the chest. (In the male, no external vocal sac; a dark roughened callosity on top of first finger.)

Dimensions.—Head and body 79 mm.; head length 23 mm., width 26 mm.; femur 30 mm.; tibia 32 mm.; foot 26 mm.; hand 21 mm.

Color in alcohol.—Upper surface of body China blue, with small white spots scattered irregularly upon it; sides of body with a very sharp but irregular line of demarcation between this dorsal coloring and a white lateral band that runs between axilla and groin, of which the lower anterior half is set off by a black line beginning at the angle of the jaw, continuing in front of the shoulder and below the axilla; in the groin and along the sides a few large irregular blue spots in this white field. Upper surfaces of arms blue, except for fingers and a white band around upper arm continuous with the white lateral area. Upper leg surfaces blue, except that inner parts of tarsus and foot are white, with a few irregular blackish bars extending across anterior and posterior parts of femur, and on inner tarsus. A narrow glandular white line edged with back along the lower lip, continuing behind angle of mouth and widening to form the white lateral band previously mentioned; a white line along outer part of forearm and hand following the glandular ridge, another along outer side of foot from tip of fifth toe to heel, on which region it is very prominent, and another on the transverse glandular ridge in front of the anus, all these white lines more or less edged with black. Anal region blackish. Ventral surface immaculate pale olive-buff. Throat (in AMNH 17414) and chest coarsely reticulated with dark brown.

Color in life.—From a painting by Sandig. Upper parts bottle green to grass green; a white line along border of lower lip continued across and in front of forearm as a widening white stripe edged below by black, and changing midway on the sides and in groin to ochre yellow. Forearm white tinged with violet below with a few delicate brown or black reticulations. Fingers brown, the disks white. Lower parts of legs ochre yellow, paling to cream-buff on the feet. Throat and breast seal brown with several large chrome-yellow spots, belly pale cinnamon, anal region darker. Iris pale smoke gray to pale pea green, with the pupil a vertical black slit.

Variations.—Three adult males, USNM 96922–4, from Montserrat, Campo Bello, all show a brown roughened pad on the upper side of the base of the first finger on the semicircular projection. They agree in having the sides of the head and body, as well as part of the upper limb surfaces, much paler than in the described specimen. The narrow black area in front of shoulder and axilla limiting the lower border of the white lateral stripe is also much reduced or lacking in these examples. While they all have rather decidedly pointed snouts, the largest example appears to have almost a "shovel-snout," as in profile there is a little ridge before it slopes down to the mouth-opening. In all three, the parotoid gland is easily visible to a point midway from axilla to groin.

A young example, USNM 96925, also from Campo Bello, shows the heavy marblings on anterior and posterior femoral surfaces, as well as other specific color characters even at its small size of 24 mm. in head and body length.

Specimens examined

BRAZIL: MRHN IG 3310 Reg. 371 (2), van Beneden; ZSBS 1191/0, Salvin.

BAHIA: Bahia, MRHN IG 3675 Reg. 371.

DISTRICTO FEDERAL: Campo Grande, AMNH 17414, A. Lutz, Feb. 15, 1921.

RIO DE JANEIRO: Estrella, USNM 96440, Venancio, March 1929. Mendes, ZSBS 9/1933 (2), Erdmann, June 29, 1933. Montserrat, Campo Bello, USNM 96922–4, A. Lutz, Feb. 17, 1923; USNM 96925, A. Lutz, 1924.

SÃO PAULO: Cerqueira César, IB 578. Chavantes, IB 98–100. Iguapé, IB 601–2, Yunquirra, 1917–18. Itapira, IB 560.

***Phyllomedusa guttata* A. Lutz**

PLATE 19, FIGURES C, D

1924. *Phyllomedusa guttata* A. LUTZ, 1924b, p. 241 (type locality, mountains near Rio de Janeiro); 1926a, pp. 8, 14.—LUTZ and LUTZ, 1939b, pp. 219, 225.—MYERS, 1946, pp. 14, 32.—B. LUTZ, 1947, p. 244; 1949b, p. 551.

Description.—Adult male, USNM 96338 (cotype), Corcovado, city of Rio de Janeiro. No vomerine teeth, but vomer with slight rugosities where teeth would normally appear; tongue cordiform, one-half as wide as the mouth opening, with a very slight indentation on its free posterior border; snout short, bluntly pointed when viewed from above and squarely truncate in profile, slanting downwards and slightly backwards, so that the tip of the snout projects somewhat in front of the lower jaw; nostrils lateral, almost at tip of snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis angular and distinct; loreal region slightly concave and nearly vertical. Eye large and very prominently projecting, its diameter slightly exceeding its distance from end of snout; interorbital diameter 1½ times the width of upper eyelid, much greater than distance between nostrils. Tympanum rather indistinct and covered by skin, its diameter apparently about one-third that of eye, separated from the eye by an interval equal to one-third its diameter; no supratympanic glandular ridge; no parotoid gland. Fingers moderate in length, without a basal web, first shorter than second and apparently only slightly opposable, second shorter than fourth, disk of third covering about four-fifths the tympanic area; base of first finger with a semilunar callosity; no true glandular ridge from base of fourth finger to elbow; toes webbed very slightly at the base, first shorter than second, disk of third covering nearly the entire tympanic area; a small blunt inner but no outer metatarsal tubercle; no tarsal ridge on inside of foot, but a very distinct one beginning on outside of fifth toe, extending along tarsus to heel; apparently no transverse glandular ridge in front of anus. Body moderately elongate, the width of head contained slightly less than 3 times in distance from tip of snout to coccyx; when hind limb is adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow overlap considerably; when hind legs are bent at right angles to the body, heels overlap. Skin of upper parts faintly shagreened, with a faint glandular dorsolateral ridge beginning above the shoulders and fading out at the beginning of the sacral region; skin of throat and chest very minutely granular, that of belly and lower femur a little more heavily granular. A circle of pustules around anal region. Apparently no skinfold across the chest. No external vocal sac. A roughened dark excrescence on callosity at base of first finger.

Dimensions.—Head and body 35 mm.; head length 10 mm., width 11 mm.; femur 16 mm.; tibia 17 mm.; foot 11 mm.; hand 9 mm. The forearm is well developed, the upper arm very weak, hence it becomes difficult to extend the arm properly.

Color in alcohol.—Upper surface of head and body vinaceous, this color likewise appearing on outer surfaces of forearm and hand between the weak glandular ridges as well as in a thin stripe, along upper part of femur, which widens upon the tibia and extends upon outer tarsus and foot between the faint glandular ridges. Remainder of upper surface, sides, and ventral surface pale olive-buff, immaculate.

Color in life.—From a painting of the described cotype by Sandig. Upper parts of head, body, and limbs apple green to grass green, with a few minute dark spots sparsely scattered over it; lateral region as well as front and back of femur cadmium orange to orange-vermilion, invaded by indigo spots. Forearm cream anteriorly, cadmium yellow towards elbow; fingers and toes immaculate chrome yellow. Iris white to light beryl green; pupil a black vertical ellipse.

Another color sketch by Honorio of an example from Tijuca, collected November 13, 1929, shows the following colors: Upper surfaces apple green, darkening slightly on the head; a number of black ocellated spots scattered on the back and some more numerous minute black dots on the head; sides of body and limbs ochraceous rufous; upper surfaces of feet and hands immaculate ochraceous-buff; nuptial pad at base of first finger black; iris pale cream-buff; pupil a black vertical slit.

Variations.—Only one partly grown frog from Serra da Bocaina, USNM 96550, is at hand. This specimen shows a decided difference in color pattern from the typical Rio de Janeiro *guttata,* because it has a very heavy marbling of dark (maroon purple in alcohol) spots along both sides of femur and tibia, and similar but smaller spots on upper arm and along inner forearm, the spots being particularly dark and conspicuous on upper surface of hand and foot. The dark spots on the sides of the body tend to a more linear arrangement, while their upper edges are sharply set off by a narrow white line which originates behind the angle of the mouth and continues down the sides to the groin, then along femur and on tibia where the narrow glandular ridges appear. Some slight differences in proportion also exist; the adpressed heel reaches the nostril in the Serra da Bocaina frog, due to an apparently greater tibial length, since the overlapping of heels is greater when hind legs are bent at right angles to body. The toes and fingers of this specimen also appear more slender than in the Rio de Janeiro specimens, but this may be due to the obvious drying out of the specimen. In a series of newly metamorphosed frogs, USNM 96551–6, accompanying the one from Serra da Bocaina, just discussed, nearly all show a trace of marbling on the legs also, but this pattern is not well developed in the young at that stage, as two others, USNM 96548–9, from the same place fail to show it.

Without additional adult material from Serra da Bocaina or the neighboring territories, it does not yet seem feasible to bestow a subspecific name based on the specimen mentioned above, or to apply to it the name *fimbriata* proposed by Miranda-Ribeiro (1923, p. 4), based on a frog from Alto da Serra, São Paulo.

Remarks.—Dr. A. Lutz found this species to be fairly common near mountain brooks in the States of Rio de Janeiro and São Paulo. The adults habitually sleep in the daytime. The voice is the same as that of *P. appendiculata* and *P. rohdei,* a long rasping sound followed by two or three clucking notes.

No eggs of this species have yet been collected, but numerous funnel-mouthed tadpoles have been taken in eddies at the foot of cascades. The tadpoles can easily be seen hanging from the surface by their funnels.

The smallest tadpole, one of USNM 96227, collected on February 25, has a total length of 33 mm.; the head and body, exclusive of mouth-disk, being 12 mm.; at this stage the posterior limb buds are just beginning to appear. The mouth is on the upper surface of the head, equipped with a black serrate beak very much like that of ordinary tadpoles, while above the beak is a single transverse row of heavily pigmented teeth which may be broken at the midline, and below the beak two other rows of teeth, the inner one usually discontinuous in the middle. The membranous disk has four elongate glands leaving the region of the beak diagonally, and numerous small round glands appear in more or less regular groupings around the edge of the membrane. An older tadpole from the same lot, with a head-and-body length of 16 mm., has the hind limbs well developed and the fore limbs lying just under the skin ready to break through. The total length at this stage is 46 mm., and the pointed tail indicates that its absorption has probably not yet begun. Two other tadpoles from Tijuca, USNM 96226, and two from Rio de Janeiro, USNM 81148, agree with the others in having three transverse rows of small but heavily pigmented teeth.

In a series of 20 larvae, USNM 96642, from Bonito, Serra da Bocaina, collected January 2–19, the transverse rows of teeth are undeveloped, while only the inner row below the beak is pigmented. In only one or two of these tadpoles can any teeth be seen on the transverse ridge occurring in the position where the upper row of teeth so prominently appears in Tijuca tadpoles. The mouth membrane is not so large in the Serra da Bocaina tadpoles.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, USNM 81147–8, A. Lutz. Paineiras, on the slope of Corcovado, USNM 96338 (cotype of *P. guttata*), A. Lutz, November 1923. Sumaré, USNM 96317 (cotype of *P. guttata*), A. Lutz, Jan. 28, 1920. Tijuca, USNM 96224–5, A. Lutz, November 1923; USNM 96226 (tadpoles), A. Lutz, Feb. 2, 1920; USNM 97227 (tadpoles), Venancio, Feb. 25, 1929; USNM 118996–7, B. Lutz, November 1939.

Rio de Janeiro: Serra da Bocaina, USNM 96642 (tadpoles), 96548–56, A. Lutz, Jan. 2–19, 1930; USNM 96643 (tadpoles), A. Lutz, March 1934.

***Phyllomedusa rohdei* Mertens**

Plate 19, Figures e–g

1926. *Phyllomedusa rohdei* Mertens, 1926c, p. 140 (type locality, Rio de Janeiro); 1929, p. 287.—Lutz and Lutz, 1939b, pp. 219, 240.—Myers, 1946, pp. 14, 32.—B. Lutz, 1949b, p. 551.

1926. *Bradymedusa moschata* Miranda-Ribeiro, p. 104, fig. 61 (type locality, Teresópolis, Rio de Janeiro).—Mertens, 1929, p. 287.

Description.—Adult male, USNM 99110, Manguinhos, Districto Federal. Vomerine teeth lacking; tongue small, ovoid, less than one-half as wide as mouth opening, not indented on its free posterior border; snout moderate in length and truncate when viewed from above and in profile, the upper jaw not projecting beyond the lower; nostrils lateral, scarcely projecting, their distance from tip of snout about one-third that to eye, separated from each other by an interval nearly equal to their distance from eye. Canthus rostralis prominent though rounded; loreal region concave and nearly vertical. Eye large, rather prominently projecting, its diameter almost as great as its distance from tip of snout; interorbital diameter only slightly exceeding the width of upper eyelid, a little greater than distance between nostrils. Tympanum distinct though covered by skin, its greatest diameter equal to two-fifths that of eye, separated from eye by an interval equal to one-half its diameter. Parotoid gland represented only by a slight swelling just above and behind tympanum. Fingers moderate in length, not webbed, first shorter than second and apparently slightly opposable, fourth shorter than third, disk of third covering over one-half the tympanic area; a slight thickening at base of first finger; a distinct glandular ridge from fourth finger along outer forearm to elbow; toes not webbed, first much longer than second and highly opposable to it, disk of fourth covering almost one-half the tympanic area; apparently no inner or outer metatarsal tubercles; a slight inner and a very prominent outer tarsal ridge, the latter beginning on fifth toe and extending across heel; no dermal appendage on heel; a distinct transverse glandular ridge in front of anus. Body rather elongate, the width of head contained 3 times in distance from tip of snout to coccyx; when hind leg is adpressed, heel reaches to anterior tympanum; when limbs are laid along the sides, knee and elbow just meet; when hind legs are bent at right angles to the body, heels overlap considerably. Skin of upper parts very finely shagreened; skin of throat, chest and belly finely and uniformly granular, that of lower part of femur and postanal region more coarsely granular. Apparently no skinfold across the chest. No external vocal sac. A dark, roughened callosity on base of first finger.

Dimensions.—Head and body 36 mm.; head length 11 mm., width 12 mm.; diameter of eye 5 mm.; femur 15 mm.; tibia 16 mm.; foot 12.5 mm.; hand 9.5 mm.

Color in alcohol.—Upper surfaces of head and body French gray, the outer forearm and the distal part of femur and entire upper tibia gray with a pinkish suffusion, rest of upper limb surfaces pinkish buff to vinaceous-buff; sides and venter cream-buff; a coarse Indian purple network on forearm and on anterior and posterior femur, extending forward along the sides for a little way beyond the groin and changing into irregular, hairlike, dark markings that cover the anterior parts of sides and belly, and on the side of head and loreal region reduced to small black spots.

Color in life.—From color sketch, probably by Sandig, of a specimen for which the locality was not noted. Upper parts of head and body, as well as a thin stripe on femur, entire upper tibia, and a stripe along outside of tarsus, apple green; upper arm, sides, anterior and posterior femur and anterior tarsus coral red, the forearm and both femoral areas with a coarse network of sepia; upper surfaces of hands and feet pinkish buff, the disks slightly darker; ventral surfaces clay color, lightening to buff on throat, with many small black spots everywhere; anal region and lower surface of tarsus Indian purple, the glandular ridge edging these areas anteriorly white; iris pale wood brown tinged with drab, the iris black and vertical.

From a living specimen, USNM 97243, from Manguinhos, the following color notes were taken on the date of its death, June 21, 1935: Dorsum and upper limbs between citron yellow and apple green, spotted posteriorly and on the snout with small gray dots. Throat, anal region, and heels below pale malachite green, chest and belly pale orange-buff. Webs of fingers and toes as well as entire anterior and posterior distal parts of femur brilliant cadmium orange. Outer ring encircling iris marine blue. Iris cinereous. Pupil black, vertical, opening from a narrow slit to an elliptical shape.

Variations.—In a series of 18 adults from near the city of Rio de Janeiro, the relative stability of the specific characters is well attested. The relatively large head and the enlarged disks of fingers and toes are quite apparent in well-preserved specimens, while the dark, coarse network pattern on femur, sides, and forearm appears on every unfaded specimen. The tongue is subject to some variability in size, and this does not appear to be entirely due to the mode of preservation. For instance, in USNM 96123 the tongue is only slightly over one-third of the mouth-opening, while in USNM 96124 from the same lot the tongue measures a full two-thirds of that distance. A very slight indentation is sometimes visible on its posterior border. The usual slight differences in femur and tibia length appear in the series. In color, some are more heavily patterned than others. On loreal region and under eye and tympanum a few short gray longitudinal lines are sometimes present, being made up of the fusion of gray dots which in other examples are scattered in this region. In a few examples, a distinct white line appears on the upper eyelid, widening above the ear and continuing over the shoulder until it is invaded by the black dots and later by the coarse network on the sides. The ventral surface may be nearly immaculate, or rather heavily spotted with dots and dark vermiculations. A few black spots occur irregularly on the back of some individuals. On the whole, the species is easily recognizable and seems to vary little.

Remarks.—A topotype of *Bradymedusa moschata*, USNM 101721, corroborates Mertens' supposition that *moschata* is identical with *rohdei*, described only a day earlier.

In captivity this frog appears to sleep steadily all day and wakes at night. It has often been collected in and near the city of Rio de Janeiro, where it is not rare. The eggs are laid on leaves, often of orange trees. A cluster of about 40 eggs, USNM 96210, was taken at Amorim in January 1926. The eggs measure 2 mm. in diameter, and are evidently at an early stage of development, as their shape is still nearly spherical; they are without large transparent outer envelopes as in *Hyla* eggs and are apparently covered and cemented together by an opaque jellylike substance. The mass is applied to the tip and edges of a small leaf, which retains its tubular form due to its having been folded around the eggs. Another clutch of eggs taken from an orange tree at Manguinhos on February 22, 1926, numbers 105 larvae, some of which are just on the point of leaving the nest, having attained a complete though diminutive tadpole form. The tadpole at this stage has a total length of between 10 and 11 mm., the tail comprising two-thirds of this, and the gills are well on the way to complete absorption before it enters the water. Among some tadpoles taken at Manguinhos in February 1923, USNM 96154, two on which hind legs are in evidence but on which the forelimbs are not yet out measure 40 and 42 mm., respectively, in total length and the head and body in both measures 15 mm.; in a third, metamorphosis is nearly complete and the head and body are 16 mm. in length.

Specimens examined

BRAZIL:

DISTRICTO FEDERAL: Amorim, USNM 96210 (eggs), A. Lutz, January 1926. Bom Successo, USNM 96155–61, A. Lutz, 1920. Manguinhos, USNM 96121–6, 96154, 97243, 99110–4, A. Lutz. Recreio dos Bandeirantes, USNM 97575, B. Lutz, Cochran, and Venancio, Feb. 9, 1935. Rio de Janeiro, USNM 91145–6, A. Lutz; ZSBS, A. Lutz, 1923. Tijuca, USNM 97401–2, A. Lutz, Cochran, and Venancio, Jan. 21, 1935.

MINAS GERAIS: Passa Quatro, USNM 96912–3, Zikan, 1923.

RIO DE JANEIRO: Niterói, USNM 96399, A. Lutz, October 1923. Teresópolis, USNM 101721, Miranda-Ribeiro.

Genus *Trachycephalus* Tschudi

1838. *Trachycephalus* TSCHUDI, p. 74. (Genotype, *Trachycephalus nigromaculatus* Tschudi.)

This genus, as well as *Aparasphenodon*, is easily distinguished from *Hyla* and *Phyllomedusa* by having the derm of the head involved in the cranial ossification. In *Trachycephalus* the snout is not bony or enlarged beyond the limits found in the genus *Hyla*, but in *Aparasphenodon* the heavily ridged casque is continuous with the extended bony rim of the upper lip, which projects considerably beyond the labial border.

Trachycephalus and *Aparasphenodon* are provided with palatine as well as vomerine teeth, both lacking the parasphenoids.

The pupil in *Aparasphenodon* is diamond-shaped, but in *Trachycephalus* it is a transverse slit, either wide or narrow depending on the amount of light to which the living frog has been subjected.

Generic diagnosis.—Head large, rugose; snout rounded; a bony crest between tip of snout and eye; nostrils below canthus rostralis; eyes large; tongue subcircular, large, entirely attached; palatine teeth few, small but strong; digits depressed, broad, with an apical disk; fingers barely connected with a basal membrane; toes semipalmate; tympanum conspicuous.

Trachycephalus nigromaculatus **Tschudi**

Figure 19; Plates 19, Figures h, i, 34, Figure b

1838. *Trachycephalus nigromaculatus* Tschudi, p. 74 (type locality, America meridionalis).—Miranda-Ribeiro, 1926, p. 94; 1937a, p. 56.—Lutz and Lutz, 1939b, p. 251.—Carvalho, 1941, p. 101, fig. 3.—Schubart, 1939, p. 53.

1841. *Trachycephalus geographicus* Duméril and Bibron, p. 536 (type locality, Brazil).—Günther, 1858, p. 118.—Cope, 1863, p. 43.—Steindachner, 1867, p. 63.

1864. *Trachycephalus marmoratus* Steindachner, 1864a, p. 243, pl. 9, fig. 3 (type locality, Corcovado, Districto Federal, Brazil).

1867. *Trachycephalus flavolineatus* Steindachner, p. 64.—Miranda-Ribeiro 1926, p. 97.

1882. *Hyla nigromaculata* Boulenger, 1882a, p. 368.—Boettger, 1892, p. 40.—Baumann, 1912, p. 163.—Nieden, 1923, p. 299.—Mertens, 1926a, p. 1; 1926c, p. 137; 1928, p. 299, fig. 3; 1950, p. 174.—A. Lutz, 1927, p. 40.—deWitte, 1930a, p. 226.—Myers, 1946, pp. 14, 31.

1893. *Hyla angustifrons* Werner, p. 83 (type locality, Brazil); 1894a, p. 414.

1912. *Hyla septentrionalis* (not of Tschudi) Baumann, p. 163.

Description.—Adult male, USNM 98538, Piraporinha, Minas Gerais. Vomerine teeth in two well-separated, heavy, short, transverse patches between the large choanae: palatine teeth present, well developed; no parasphenoid teeth; tongue two-thirds the width of mouth opening, rounded, with a slight notch on its partially free posterior border; top of head osseous; snout relatively short and truncate when seen from above, bluntly rounded in profile, with a slight indication of a bony ridge extending along the upper lip and another much more prominent on the canthus rostralis, the latter ending in front of the nostril; top of head and area between these ridges deeply concave; upper jaw projecting slightly beyond lower; nostrils more lateral than superior, scarcely projecting, their distance from end of snout one-half that from eye, separated from each other by an interval equal to three-fourths their distance from eye. Loreal region very concave and sloping sharply outwards. Eye large, very prominent and bulging, its diameter almost equal to its distance from end of snout; interorbital diameter 2¼ times that of upper eyelid, twice that between nostrils. Tympanum very distinct, its greatest diameter about one-half the eye diameter, separated from eye by an interval equal to one-half its own diameter. Fingers webbed at the base, fourth considerably longer than the second, reaching halfway on disk of third which covers about four-fifths the tympanic area; no apparent dermal ridges along inner or outer forearm; a rudiment of a pollex showing only as a blunt, coarse enlargement of base of first finger; toes slightly more than one-half webbed, third and fifth subequal, disk of fourth covering nearly one-half the tympanic area; a long, blunt, inner and a small, wartlike, almost invisible outer metatarsal tubercle; no dermal ridges on tarsus; a transverse skinfold below heel, but no glandular ridges on it. Body elongate but very heavily built, in postaxillary region as wide as greatest diameter of head; when hind leg is adpressed, heel reaches to posterior corner of eye; when limbs are laid along the body, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels very slightly overlap. Head bony and like fine sandpaper to the touch, especially in occipital region; a long, raised crest bordering the upper part of ear; skin of back and upper limb surfaces thick and finely glandular, with a few larger tubercles scattered on the back; a wide low glandular ridge from bony crest above ear backwards to above axilla; skin of throat coarsely granular, that of chest fairly smooth, that of belly and lower surface of femur very heavily granular. No skinfold across the chest; a pair of very prominent lateral vocal sacs extending out below the supratympanic fold behind the ear. A heavy callosity on base of first finger.

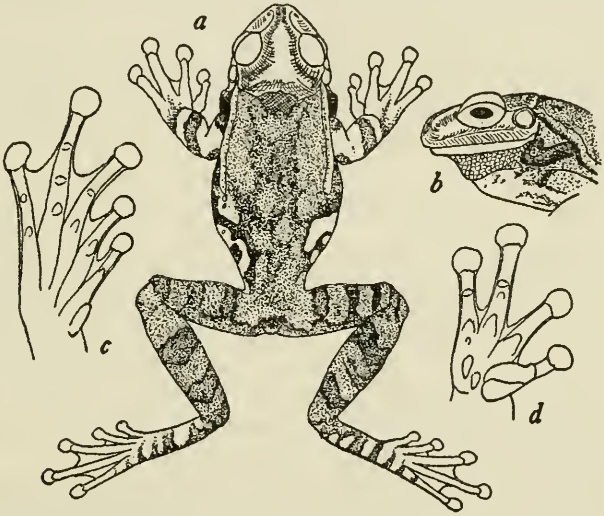


Figure 19.—*Trachycephalus nigromaculatus*, USNM 98538: *a*, Dorsum × ½; *b*, profile × ¾; *c*, foot × 1; *d*, hand × 1.

Dimensions.—Head and body 86 mm.; head length 24 mm., width 26 mm.; femur 34 mm.; tibia 36 mm.; foot 30 mm.; hand 23 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	19	19	18	19	18	18
Mean	31. 0	31. 2	41. 4	46. 8	38. 1	28. 0
Standard deviation	2. 04	1. 56	2. 90	3. 62	2. 00	2. 29
Variation	6. 6	5. 0	7. 0	7. 7	5. 2	8. 2
Standard error	. 47	. 36	. 68	. 83	. 47	. 54
Range	27. 7– 35. 6	28. 4– 35. 6	37. 2– 48. 8	41. 9– 58. 1	34. 9– 43. 2	22. 4– 31. 8

Color in alcohol.—Dorsal surfaces fawn color, with a sprinkling of coarse black spots on the back; a heavy ocellated pattern on the sides, the centers of the ocelli pale gray edged with black, and some other irregular black lines running up onto the posterior part of the back; arms and legs with brown, black-edged crossbars which fade out on anterior and posterior surfaces of femur into irregular dark mottlings; a black-edged anal spot; ventral surfaces buff, with some pale brown reticulations on the chin. External vocal sac blackish.

Color in life.—Young examples brought from Manguinhos were usually dull sage green above, with vinaceous or light maroon spots in the areas which later bleached to pale gray when the frogs were preserved. The following color notes were made on January 23, 1935, from a living specimen taken at Manguinhos: Dorsal color olive-buff, marked with large olive, black-edged spots. Posterior femur wood brown, with white spots on top of the femur. Chin and anterior part of belly white with suffusions of sepia. Lower sides of limbs and posterior part of belly ochraceous-orange.

A young specimen from Teresópolis, taken in April 1935, had the following coloration: Dorsal ground color drab, with numerous poppy-red spots outlined with clove brown; sides pale olive-buff with small black spots. Upper surface of legs and arms pale olive-buff with irregular sepia crossbands. Posterior femur pale drab. Chin and throat pale olive-buff with small round olive spots. Belly and hind legs drab below, skin of these parts translucent. Green bones are visible through the flesh. Iris coppery, with many large black spots and lines throughout.

Variations.—The bony development of the head is much greater in some individuals than in others, as might be expected. A male, USNM 52609, has head ridges which equal those of *Aparasphenodon brunoi* in sharpness, although the short snout and the less concave forehead prove that the specimen belongs to the species *nigromaculata*. The webbing on fingers and toes is practically identical in all the specimens, and there is not much variation in leg length, although the heel of USNM 97675 reaches nearly to the anterior corner of eye.

The teeth are the same in all; the tongue may be wider or narrower than that of the described specimen. In color, all seem to have a similar coarse pattern, which in the described specimen is partly incomplete. As usual, this pattern is best seen in half-grown frogs, for in adults it almost disappears on the bony rugosities of the head. A pale rectangular spot appears on the occiput just behind the eyes; around it is a branching black marking, of which the anterior branch goes along the snout, a branch goes to each eye, another pair widens on the occiput and goes along the back enclosing a very irregular pale spot, and sometimes becoming attenuate or breaking off. Just in front of the sacrum a heavy large dark blotch occurs, often continuous with the dark head markings, its posterior prolongations very irregular, enclosing several light sacral spots, and gradually becoming the dark borders for the ocellated lateral spots found on the described specimen, which has the typical leg and arm markings. The anterior dorsolateral region is usually without markings, except for a few small black dots.

Remarks.—This rather sluggish frog lives by day in bromeliads. When disturbed, it crouches and tries to hide under the leaves. Its skin is not slimy in spite of its rather glandular appearance. The call of the adult male is a hoarse cawing note, *grau, grau.* The eggs are laid in the shallow waters of a lagôa, and tadpoles and young are found from September to December. It is common in the State of Rio de Janeiro.

Live specimens allowed the freedom of the laboratory kept quiet during the day, concealed in some dark crevice usually near the water pipes, but at night their activity was very great, as they evidently sought food only at that time. It was evident that they possessed a keen sense of locality, for they found their way into the same crevice each time at the approach of daylight. An observation was once made by the collector Joaquim Venancio on a frog in a bromeliad, near Manguinhos, that for four months slept daily in the same spot in a leaf-axil, above a few inches of rainwater that had been caught there.

Some young frogs at the end of metamorphosis, taken at Manguinhos in January 1923 (USNM 96127–9), measure 20, 19, and 18 mm. respectively.

Specimens examined

BRAZIL: MHNP 4608 (cotype of *Hyla nigrolineata*), Vautier; MHNP 4609 (cotype of *Hyla nigromaculata*), Vautier.

Bahia: Bahia, USNM 75987, de Lacerda. Toca da Onça, USNM 52609, Rose, June 27, 1915.

Districto Federal: Manguinhos, USNM 96127–9, A. Lutz, January 1923; USNM 97377–9, Venancio, January–April 1935. Rio de Janeiro, USNM 81139, A. Lutz, Dec. 20, 1938.

Espírito Santo: Itá, IB 125–8, 147–54, 164–5, 194, 211, 246–7 and USNM 121349–52.

Minas Gerais: Piraporinha, USNM 98538, Cochran, Dias, and Venancio, Mar. 23, 1935. Rio das Velhas, 32 mi. north of Bello Horizonte, BM 1926.3.-16.10–11, Chalmers.

Rio de Janeiro: ZSBS (2), A. Lutz, 1932. Bonito, Serra da Bocaina, USNM 96648, A. Lutz, Oct. 28, 1931. Caxias, USNM 101129, A. Pasarelli, May 1935. Guapi, Teresópolis, USNM 97675–6, Sandig, April 1935. Niterói; MRHN IG 9404, Reg. 74, Massart, September 1922. Icarahy, BM 1924.9.20.6, Matthews. Sacco São Francisco, USNM 97637–8, Venancio, Feb. 9, 1935.

São Paulo: Bertioga, USNM 123392, P. Sawaya.

Subfamily Pseudinae

The possession of an additional phalanx in each digit seems to be a character of sufficient importance to accept the emendation to the subfamily definition made by Parker (1935, p. 511). The subfamily name to include also such genera as *Ceratophrys*, *Cycloramphus*, *Eupsophus*, *Zachaenus* and *Eleutherodactylus*, as proposed by Noble (1931, p. 499), is thus restricted to include only the members of the genus *Pseudis*.

Genus *Pseudis* Wagler

1830. *Pseudis* Wagler, p. 203. (Genotype, *Rana paradoxa* Linnaeus.)

The records of *Pseudis limellum* (deWitte, 1930a, p. 220) for Tijuca in the city of Rio de Janeiro and for Alto da Serra in São Paulo are apparently based on mislabeled specimens. No species of *Pseudis* occurs in Tijuca, the fauna of which is quite well known. The Alto da Serra frog labeled *P. limellum* is actually a *Hyla leucophyllata*, a transposition of data having undoubtedly occurred here also.

Generic diagnosis.—Pupil horizontal. Tongue circular, entire and slightly free behind. Vomerine teeth present. Tympanum distinct. Fingers free, first opposable to the others; toes webbed to the tips; tips of fingers and toes pointed or swollen into small disks. Outer metatarsals separated by a web. Omosternum cartilaginous; sternum a cartilaginous plate. Terminal phalanges simple.

Key to species of Pseudis of southeastern Brazil

a.^{1} Legs relatively slender; carpal areas not greatly enlarged; dorsum distinctly granular. . . . . **bolbodactyla** (p. 213)

a.^{2} Legs much thicker; carpal areas swollen; dorsal skin apparently smooth. **fusca** (p. 216)

Pseudis bolbodactyla A. Lutz

Figure 20; Plate 32, Figures g, h

1925. *Pseudis bolbodactyla* A. Lutz, 1925a, p. 138 (type localities, Bello Horizonte and Lassance, Minas Gerais); 1926a, pp. 5, 12.

Description.—Adult male, USNM 97022 (cotype), Lagôa de Genipapo, Lassance, Minas Gerais. Vomerine teeth in two short, heavy, transverse, well-separated patches between the choanae; tongue more than half the width of mouth-opening, cordiform, with a deep notch on its free posterior border; snout bluntly rounded at the tip when seen from above and in profile, the upper jaw projecting considerably beyond the lower; nostrils superior, scarcely projecting, their distance from end of snout almost as great as their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded, indistinct; loreal region slightly concave, almost horizontal, curving outwards to the rounded upper lip. Eye large, prominent, its diameter equal to its distance from end of snout; interorbital diameter narrower than upper eyelid, equal to distance between the nostrils. Tympanum distinct, its greatest (horizontal) diameter equal to two-thirds the width of eye, lying close behind eye. Fingers long, free, their tips very slightly dilated, second finger longer

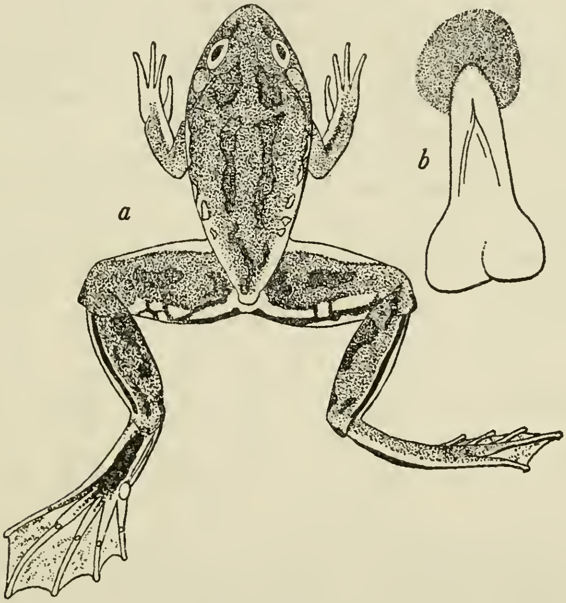


Figure 20.—*Pseudis bolbodactyla: a,* USNM 97022 (cotype), dorsum (with pattern added from USNM 98534) × $\frac{9}{10}$; *b,* USNM 98189, terminal bone of fourth toe, showing cartilaginous disk, × 36, approximately.

than first but considerably shorter than fourth; the swollen basal part of first finger merging with the indistinct metacarpal tubercle; small but distinct subarticular tubercles; toes fully webbed, the tips very slightly dilated, third and fifth subequal, reaching halfway on penultimate phalanx of fourth; a small spurlike inner metatarsal tubercle but no outer one; subarticular tubercles of toes small but distinct; a strong inner tarsal fold reaching almost to heel, and a similar ridge along margins of outer toes. Body fairly stout. When hind limb is adpressed, heel reaches well beyond tip of snout; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to body, heels are widely separated. Skin of head smooth, of back and sides coarsely granular, of upper limb surfaces nearly smooth with a few scattered pustules on tibia and some granules on upper femur; a slight supratympanic ridge; belly slightly granular anteriorly, nearly smooth posteriorly; lower limb surfaces smooth. Chin of male much wrinkled due to the presence of the large median vocal sac extending across the throat.

Dimensions.—Head and body 45.5 mm.; head length 14.5 mm., width 17.5 mm.; femur 28 mm.; tibia 25.5 mm.; foot 24.5 mm.; hand 14 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	36	36	36	36	36	35
Mean	33. 4	38. 3	60. 6	58. 9	58. 5	31. 9
Standard deviation	1. 85	1. 94	3. 42	3. 42	3. 02	1. 99
Variation	5. 5	5. 1	5. 7	5. 8	5. 1	6. 2
Standard error	. 31	. 32	. 57	. 57	. 51	. 33
Range	29. 5–36. 3	34. 7–40. 9	53. 8–67. 5	51. 9–65. 0	53. 8–65. 0	28. 0–35. 9

Color in alcohol.—This specimen has faded to russet above, buff below, with only slight traces of the dark leg stripes found in fresh specimens. Other freshly preserved examples from Lassance show the dorsal ground color to be olive-gray, lightening on the limbs; a narrow black line runs along canthus from nostril to eye; three or four elongate dark spots occur on either side of the midline of the back, the anterior being partly on the upper eyelid, the second the largest, the last two often broken up. Small black spots are scattered over the throat and sometimes on the belly. Heavy dark stripes occur not only on the posterior femur but also inferiorly and anteriorly, with slighter continuations on the tibia. The subarticular tubercles of the toes are often gray or black.

Variations.—In a fine series of 28 examples from Lassance, a relatively slight degree of variation is found. The femur is very long in this species, but in a few individuals it is especially long, so that the heels fail to meet by a considerable interval when the hind legs are bent at right angles to the body. The webs of the toes are more deeply incised in some than in others. The coloration is occasionally dark, so that the dorsal spots fail to show. The head is wide and the snout relatively blunt and short in a few frogs. The chest and belly are sometimes immaculate; often the throat is spotted with round black dots, and more rarely the belly also is similarly marked. The described specimen is the largest one at hand.

Remarks.—While the terminal bone of the toe is distinctly cylindrical and rounded at the tip, it is prolonged by a very tough, round cartilaginous plate which attaches itself to the outer skin and which is very difficult to dissect away from the bone.

The voice of this frog sounds like the grunting of a pig, or like a cough, and may be heard in the daytime. The frog is almost entirely aquatic, and floats at the surface of the water. It begins to breed in September as soon as the rains come. The tadpoles are large in size and are eaten by the natives. The adult frogs are said to be caught in the daytime on fish hooks baited with grasshoppers.

The characters separating *P. bolbodactyla* from *P. paradoxa* seem to be very slight. The tips of the fingers and toes are about equally bulbous in both species. The former, however, has a rougher skin on the back, and the upper eyelid is somewhat wider, making the interorbital diameter seem narrower. Three examples of *paradoxa* from Georgetown, British Guiana, MZUM 46161 and 83855, are smoother above, while the eyelid is less full. In these the black stripes on the thighs are relatively narrow, and very irregular in outline; in the large series of *bolbodactyla* the stripes are wider and their margins are quite regular. In *paradoxa* the light ventral color is not carried up to the axilla and onto the shoulder to any appreciable extent; in *bolbodactyla* a more or less distinct band of pale color encircles the posterior half of the shoulder. A specimen from Rurrenabaque, Bolivia, MZUM 57527, seems to have the *bolbodactyla* color characters, and its upper eyelid is also large and full, but until an adequate series from Bolivia has been secured, this specimen is referred only provisionally to *bolbodactyla*.

Specimens examined

BRAZIL:

Espírito Santo: Itá, IB 193.

Minas Gerais: Lagôa de Genipapo, Lassance, USNM 97022 (cotype), A. Lutz. Lagôa do Curralhino, near Lassance, USNM 97171–204, Cochran, Dias, and Venancio, Mar. 22, 1935. Pirapora, USNM 98534, Cochran, Dias, and Venancio, Mar. 23, 1935.

Pseudis fusca Garman

PLATE 32, FIGURES I–K

1883. *Pseudis fusca* GARMAN, p. 47 (type locality, Rio Arassuahy, [Minas Gerais,] Brazil).—NIEDEN, 1923, p. 366.—MIRANDA-RIBEIRO, 1926, p. 26.—BARBOUR and LOVERIDGE, 1929, p. 324.—MELLO-LEITÃO, 1937, p. 329.

Description.—Male, MCZ 1872 (cotype), Rio Arrasuahy, Minas Gerais. Vomerine teeth in two short, heavy, well-separated patches between the choanae; tongue slightly less than half as wide as mouth-opening, broadly oval, not indented on its free posterior border; snout bluntly rounded at the tip when seen from above and in profile, the upper jaw projecting slightly beyond the lower; nostrils superolateral, scarcely projecting, valvular, their distance from end of snout about two-thirds their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded, indistinct; loreal region flat, sloping evenly downwards to the upper lip border. Eye large, prominent, its diameter a little less than its distance from end of snout; interorbital diameter slightly greater than width of upper eyelid, a little greater than distance between the nostrils. Tympanum distinct, its greatest diameter equal to three-fourths the width of eye, separated from eye by a distance equal to one-third its greatest diameter. Fingers long, free, their tips not dilated, second finger opposed to others, longer than first but much shorter than fourth; bases of all the fingers much swollen, but having a few small metacarpal tubercles; subarticular tubercles of fingers very distinct; an elongate pad on distal part of base of first finger; toes fully webbed, their tips not dilated, third and fifth subequal, reaching halfway on penultimate phalanx of fourth; a small but distinct spurlike inner metatarsal tubercle but no outer one; subarticular tubercles of toes small but very distinct; a heavy curved inner tarsal ridge extending from base of inner metatarsal tubercle almost to heel; wide dermal fringes along the outer sides of first and fifth toes. Body stout, in postaxillary region a little wider than the head. When hind limb is adpressed, heel reaches well beyond tip of snout; when limbs are laid along the sides, knee and elbow slightly overlap; when hind legs are bent at right angles to body, heels are widely separated. Skin of head, back, and legs nearly smooth, with a few pustules at nape of neck and on femur; skin of sides below arm insertion finely plicate; a distinct supratympanic ridge; center of belly with some faint granules, remainder of venter smooth. A transverse skinfold across chest and another across throat. Internal slits on either side of mouth back of tongue leading to the vocal sacs.

Dimensions.—Head and body 53 mm.; head length 16.5 mm., width 19.5 mm.; femur 32 mm.; tibia 27.5 mm.; foot 26.5 mm.; hand

15 mm.; tympanum 4 mm. The original description is in error in stating that the length of the femur and tibia together is less than the length of the body.

Color in alcohol.—Dorsum much faded but generally wood brown; posterior femur with traces of wide dark and light longitudinal stripes; inner surface of tibia with coarse dark reticulations; venter pale, immaculate.

Remarks.—A cotype of *Pseudis fusca* was compared with a cotype and other examples of *P. bolbodactyla.* It is apparent that *fusca* is a more heavily built frog, with thicker femur and tibia. Even the carpal areas are more swollen than in *bolbodactyla.* While the skin of *fusca* appears smoother than that of *bolbodactyla,* the great age of the specimen may have caused the granulations on the back and legs to become less apparent. It is unfortunate that no additional examples of *fusca* have come to light since the original description appeared.

The Rio São Francisco, in the tributaries of which *P. bolbodactyla* was discovered, and Rio Arassuahy, the home of *fusca,* are not more than 150 miles apart at their nearest points, but they are separated by ranges of high mountains and hence are in totally different watersheds. The geographical separation between *fusca* and *bolbodactyla* is complete, and the physical differences between them seem to be great enough to warrant their being considered as distinct species.

Specimen examined

BRAZIL:

Minas Gerais: Rio Arassuahy, MCZ 1872 (cotype), Hardt and Copeland.

Family Leptodactylidae

Family diagnosis.—Procoela with no intercalary cartilage or bone between the last two phalanges supporting the claw-shaped or T-shaped terminal joint; sacral diapophyses cylindrical or dilated.

Key to genera of Leptodactylidae of southeastern Brazil

*a*¹. Sternum cartilaginous, sometimes ossifying in the middle in old animals.
  *b*¹. An antebrachial tubercle present; no tympanum or vomerine teeth; size very small, 15 mm. or less . . . . **Pseudopaludicola** (p. 355)
  *b*². No antebrachial tubercle.
    *c*¹. Fingers and toes without disks, their tips a single bony stylus.
      *d*¹. Toes webbed distinctly.
        *e*¹. No toothlike process on anterior border of lower jaw.
          *f*¹. No distinct parotoid glands present . . . . **Ceratophrys** (p. 223)
          *f*². One or several small parotoids present. . **Odontophrynus** (p. 336)
        *e*². A small toothlike process on anterior border of lower jaw. **Cycloramphus** (p. 253)

*d*². Toes free, or with only a trace of web.
  *e*¹. Vomerine teeth between the choanae; mouth not unusually wide. **Eupsophus** (p. 291)
  *e*². Vomerine teeth well behind the choanae; mouth extremely wide.
    *f*¹. An axillary wing present; femur and tibia relatively long. **Zachaenus** (p. 358)
    *f*². No axillary wing; femur and tibia relatively short. **Craspedoglossa** (p. 234)
*c*². Fingers and toes with broadened disks; bony terminal phalanges mostly T-shaped.
  *d*¹. Vomerine teeth present; upper surface of some or all finger or toe disks divided.
    *e*¹. Head long and narrow.
      *f*¹. Outer finger and toe with undivided disks. . . **Basanitia** (p. 218)
      *f*². Disks of toes undivided (except sometimes in *parvus*). **Eleutherodactylus** (p. 269)
    *e*². Head wide and short; all the digits with divided disks.
      *f*¹. Head moderately broad; hand and tibia relatively long; size moderate, up to 50 mm. . . . . **Elosia** (p. 280)
      *f*². Head very broad; hand and tibia relatively short; size large, up to 115 mm. . . . . **Megaelosia** (p. 333)
  *d*². Vomerine teeth lacking.
    *e*¹. A heavy pad of black spicules on thumb . **Crossodactylodes** (p. 237)
    *e*². No thumb pad . . . . **Phrynanodus** (p. 340)
*a*². Sternum bony, with a posterior cartilaginous expansion.
  *b*¹. Fingers and toes with distinctly enlarged terminal disks, which have a median furrow above, separating two padlike swellings (less distinct on fingers) . . . . **Crossodactylus** (p. 240)
  *b*². Fingers and toes lacking enlarged terminal disks, but sometimes slightly dilated.
    *c*¹. Vomerine teeth lacking.
      *d*¹. Quadratojugal reaching to maxillary. . . . . **Physalaemus** (p. 341)
      *d*². Quadratojugal absent . . . . **Pleurodema** (p. 354)
    *c*². Vomerine teeth present, large and prominent . . **Leptodactylus** (p. 301)

Genus *Basanitia* Miranda-Ribeiro

1923. *Basanitia* MIRANDA-RIBEIRO, 1923d, p. 851. (Genotype, *Basanitia lactea* Miranda-Ribeiro.)

Generic diagnosis.—General appearance of *Eleutherodactylus* with depressed head and snout rounded anteriorly. Maxillary teeth present; vomerine teeth in two groups behind the choanae; palatines present. Pupil horizontal. Sacral vertebra subcylindrical, not dilated. Tympanum distinct; aperture of Eustachian tubes separated, large. A subgular vocal sac. Fingers and toes provided with distinct terminal disks, divided as in *Elosia*, from which this genus differs by the hyloid form of the head and other characters.

Key to species of Basanitia of southeastern Brazil

a.[1] Adpressed heel reaching far beyond tip of snout; disks of third finger and fifth toe covering about ½ the tympanum; size up to 23 mm. . **bolbodactyla** (p. 219)
a.[2] Adpressed heel reaching center of eye; disk of third finger larger than tympanum, that of fourth toe a little smaller, size up to 33 mm. . **lactea** (p. 220)

Basanitia bolbodactyla (A. Lutz)

Plate 20, Figures a–d

1925. *Eupemphix bolbodactyla* A. Lutz, 1925a, p. 138 (type locality, Angra dos Reis, Rio de Janeiro); 1926a, pp. 5, 12.
1926. *Basanitia gehrtii* Miranda-Ribeiro, p. 52 (type locality, Alto da Serra, São Paulo).—A. Lutz, 1931, p. 240, pl. 65, figs. 17, 18.

Description.—Adult, Lutz coll., Serra das Orgãos, Rio de Janeiro. Vomerine teeth in two small, round, well-separated groups far behind and well within the inner borders of the choanae. Maxillary teeth well developed; apparently no transverse row of odontoids on the palatine bone; tongue covered with very small glandules, medium sized, its width equaling about one-half the mouth-opening, notched and free posteriorly; a small toothlike process in front of lower jaw; snout obtusely pointed when seen from above, rounding in profile, the upper jaw projecting beyond the lower; nostrils lateral, nearer to tip of snout than to eye, separated from each other by a distance slightly less than their distance from eye. Canthus rostralis prominent, the loreal region concave, and the upper lip flaring out below it. Eye large, its diameter nearly equal to its distance from end of snout; interorbital diameter equal to width of upper eyelid. Pupil transversely elliptical. Tympanum distinct, small, the encircling rim not very apparent posteriorly, its diameter equal to one-half that of eye, separated from eye by an interval equal to two-thirds its own diameter. Fingers free, without lateral ridges, the tips of the third and fourth dilated into moderately large disks which are heart-shaped (notched on top), that of the third finger covering slightly more than one-half the tympanic area; tips of first and second fingers only a little enlarged, ball-like; fourth finger longer than second, reaching to base of disk of third; no rudiment of a pollex; subarticular tubercles single, strongly developed, but carpal callosities scarcely evident; toes free, with distinct lateral ridges, all their disks somewhat enlarged and notched, the disk of the fourth toe about equal to that of third finger; fifth toe considerably longer than third; a small, oval, prominent inner metatarsal tubercle and a smaller round outer one; subarticular tubercles of toes well developed; no plantar tubercles; a prominent transverse tubercle on the heel; no tarsal ridge. Body slender, in postaxillary region a little narrower than greatest width of head; when hind leg is adpressed, heel reaches to far beyond end of snout; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to the body, heels overlap greatly. Skin of upper parts finely glandular, with a fairly distinct dorsolateral ridge; small tubercles on upper lip, on eyelids, and between the eyes; a weak supratympanic fold, and a short gland just above the corner of the mouth; venter smooth; a few granules behind anus extending a short distance onto the femur. Possibly an indistinct ventral disk?

Dimensions.—Head and body 23 mm.; head length 9 mm., width 8 mm.; femur 13 mm.; tibia 16 mm.; hind limb 45 mm.; fore limb 15 mm.

Color in alcohol.—Dorsum clove brown, with a narrow, light sepia interorbital bar; femur light sepia with about five wide, dark bars above, and a finely reticulated dark area on posteroventral surface, this latter separated from the dark bars distally by a conspicuous pale area; tibia sepia, with a longitudinal clove-brown stripe on its outer surface, and some indistinct dark marblings above; sides of body white, with fine dark reticulations especially prominent in axillary region; venter white, the throat and chest heavily reticulated with dark; upper lip with a dark triangle pointing into the eye, preceded and followed by a narrow, pale bar; tarsus and forearm heavily barred with clove brown.

Specimens examined

BRAZIL:

Rio de Janeiro: Angra dos Reis, USNM 96542–3 (cotypes of *Eupemphix bolbodactyla*), Pugas, January 1925. Organ Mountains National Park, near Teresópolis, Lutz Coll., B. Lutz and Venancio, March 1945.

Basanitia lactea **Miranda-Ribeiro**

FIGURE 21

1923. *Basanitia lactea* Miranda-Ribeiro, 1923d, p. 851, pl. 1 (type localities, Iguapé, and Campo Grande, São Paulo); 1926, pp. 50, 201, fig. 30.—A. Lutz, 1931, p. 239, pl. 64, figs. 10, 11, pl. 65, fig. 19.—Mello-Leitão, 1937, p. 315.

Description.—Redescription of adult female, MP 828 (type), Iguapé, São Paulo. Vomerine teeth in two small, oblique, narrowly separated patches behind the choanae and well within their internal margins; maxillary teeth well developed; a transverse row of odontoids on the palatine bone; tongue covered with small conical glandules, large, its width equalling more than three-fourths the large mouth-opening, notched and free posteriorly; a very minute toothlike process in front of lower jaw; snout semicircular in outline when seen from above, rounding in profile, the upper jaw projecting beyond the lower;

nostrils more lateral than superior, nearer to tip of snout than to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis well defined, the loreal region concave, the upper lip flaring out at an obtuse angle below it. Eye large, its diameter nearly equal to its distance from end of snout; interorbital diameter barely as great as that of the wide upper eyelid which is clearly set off from the top of the head. Pupil transverse. Tympanum rather indistinct, small, without a prominent encircling rim, its diameter equal to one-third that of the eye, separated from eye by an interval of 1½ times its own diameter. Fingers free, without lateral ridges, the tips of the second, third, and fourth dilated with large disks, notched at the tips (heart-shaped), that of the third finger larger than the tympanic area; tip of first finger rounded and ball-like but scarcely dilated; fourth finger longer than second, reaching nearly to base of disk of third; no rudiment of a pollex; subarticular tubercles single, strongly developed, but carpal callosities scarcely evident; toes free, without lateral ridges, all their disks enlarged and notched, that of the fourth toe larger than the others but much smaller than those of the fingers, covering a little less than the area of the tympanum; fifth toe very slightly longer than third, reaching to base of antepenultimate phalanx of fourth; a small but prominent oval inner metatarsal tubercle and a weaker smaller outer one; subarticular tubercles of toes very well developed; a prominent tubercle on heel, but no tarsal ridge. Body rather stout, in postaxillary region greater than greatest width of head; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the body, knee and elbow are well separated; when hind legs are bent at right angles to body, heels overlap. Skin

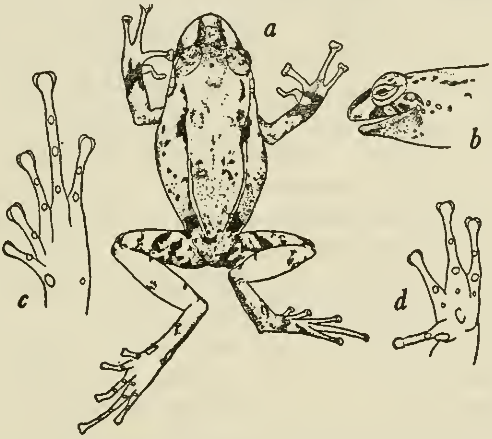


Figure 21.—*Basanitia lactea*, MP 828 (type): *a*, Dorsum × 1; *b*, profile × 1; *c*, foot × 2; *d*, hand × 2.

of upper parts quite smooth except for a few small tubercles on upper eyelid, snout, and coccyx, and a faint median glandular line on top of head; a weak post-tympanic diagonal ridge, with three or four large tubercles behind the corner of the mouth; a very slight indication of a low, wide dorsolateral glandular ridge; venter smooth, excepting for a large patch of coarse granules behind anus extending halfway along the lower surface of femur. A ventral disk indicated by a weak ventrolateral skin fold.

Dimensions.—Head and body 33 mm.; head length 11 mm., width 11 mm.; femur 14 mm.; tibia 15 mm.; hind limb 47 mm.; fore limb 21 mm.

Color in alcohol.—Dorsal ground color cream-buff; a narrow chocolate line along canthus, and a triangular chocolate mark from eye to edge of lip, followed by two smaller diagonal dark marks to corner of mouth; a very irregular series of dark spots from behind eye along dorsolateral region, the largest of these spots coming above the shoulder, with another diagonal one on the side running down to the groin; some coarse dark spots along the sides beginning in the axilla; upper surface of femur with two or three narrow, irregular, diagonal crossbars; upper tibia and upper arm immaculate except for a few scattered dark spots; foot and forearm indistinctly barred and spotted; venter drab-gray, with faint darker suffusions over chest, throat, belly, and lower leg surfaces; upper surfaces of digital disks darkened.

Remarks.—This frog is indeed very distinct from other known Brazilian leptodactylids. It has a decided similarity, however, to *Eleutherodactylus latidiscus*, from Panamá, in which species the disks are very large on the outer fingers and toes and much reduced on the inner ones, although not to such an extent as in *B. lactea.* The snout is also of a similar shape, while the vomerine tooth patches are alike in size and position. The palatine ridge in *latidiscus* is likewise roughened into small odontoid serrations which can readily be felt with the head of a pin. The size of *latidiscus* is greater, its digital disks are not so distinctly incised, and its color pattern is somewhat different from that of *Basanitia lactea.* After additional examples of the latter have been collected and carefully compared with all the tropical American eleutherodactylids, it may be advisable to include them all under the same generic name.

Specimens Examined

BRAZIL:

Rio de Janeiro: Montserrat, Campo Bello, USNM 96937, A. Lutz, February 1924. Teresópolis, USNM 121634, B. Lutz and Venancio, December 1940.

São Paulo: Iguapé, MP 828 (type), Edwall.

Genus *Ceratophrys* Wied

1824. *Ceratophrys* Wied, 1824b, p. 672. (Genotype *Ceratophrys varius* Wied.)

Generic diagnosis.—Pupil horizontal. Tongue heart-shaped, free behind. Vomerine teeth. Tympanum more or less distinct, or hidden. Fingers free; toes more or less webbed, the tips not dilated. Outer metatarsals united. Omosternum cartilaginous; sternum a cartilaginous plate which ossifies in the fully adult state. Terminal phalanges simple. Upper eyelid produced into a more or less distinct horn or a series of warts.

For a statistical analysis of the species of *Ceratophrys* here discussed, see pages 373 and 380.

Key to species of Ceratophrys of southeastern Brazil

a^1. Upper eyelid with a more or less developed horny projection.
  b^1. A bony shield in center of back.
    c^1. Heel reaches to between eye and nostril; horn on upper eyelid distinct, not quite as long as eye . . . . **varia** (p. 232)
    c^2. Heel does not reach to eye; upper eyelid three-cornered, with a very short horn . . . . **ornata** (p. 230)
  b^2. No bony shield on back.
    c^1. Heel reaches to eye; skin appendages on sides of head, body, and hind legs; tympanum indistinct . . . . **appendiculata** (p. 223)
    c^2. Heel reaches only as far as axilla.
      d^1. Vomerine teeth in distinctly separated groups; first and second fingers subequal; snout marbled with brown and tan . . . . **boiei** (p. 225)
      d^2. Vomerine teeth barely interrupted; first finger longer than second; snout white . . . . **fryi** (p. 230)
a^2. Upper eyelid with 4 or 5 rows of warts . . . . **cristiceps** (p. 228)

Ceratophrys appendiculata Günther

Plate 20, Figures e, f

1873. *Ceratophrys appendiculata* Günther, p. 418 (type locality, Brazil).—Boulenger, 1882a, p. 25, pl. 1, figs. 1,a, 1,b.—Wandolleck, 1907, p. 9.—Baumann, 1912, p. 161.—Miranda-Ribeiro, 1920d, p. 293.—L. Müller, 1922, p. 171; 1927, p. 286.—Nieden, 1923, p. 382.—Mertens, 1930, p. 162.

1879. *Ceratophrys cafferi* Camerano, p. 880 (type locality, Organ Mountains, Brazil).

1920. *Stombus appendiculatus* Miranda-Ribeiro, 1920d, p. 302; 1926, p. 124, pl. 15, figs. 1–1,b.

1926. *Stombus appendiculatus unicolor* Miranda-Ribeiro, p. 125 (type locality, Alto da Serra, São Paulo).

1926. *Stombus melanopogon* Miranda-Ribeiro, p. 125, pl. 15, figs. 2–2,b (type locality, Alto da Serra, São Paulo).

Description.—Adult male, USNM 121320, Barrão H. de Mello, Rio de Janeiro. Vomerine teeth in two short, slanting, narrowly separated series between the choanae; tongue about two-fifths as wide as mouth-opening, cordiform and deeply notched on its free posterior border; snout short, ending in a pointed dermal appendage, appearing concave in profile because of this appendage; upper jaw projecting considerably beyond lower because of the appendage; nostrils superior, at the intersection of the very sharp canthus rostralis and an oblique loreal ridge, separated from each other by an interval equal to two-thirds their distance from eye. Canthus rostralis raised, curved and sharp, the area between the canthi very concave; a lesser ridge crosses this area between the anterior corners of the eyelids; loreal region sloping obliquely and slightly concave except for the heavy diagonal ridge originating just below the eye and ending at the nostril. Eye large and prominent, but appearing less so because of the upper eyelid which is elongated into a very long dermal horn; diameter of eye equal to its distance from nostril. A heavy ridge continued backward from each canthus and over the occipital region, the distance between the crests in the interorbital region about four-fifths the width of upper eyelid plus horn. Tympanum barely visible, its distance from eye apparently equal to its own diameter. Fingers slightly webbed at the base, with heavy dermal ridges along their sides, their tips not dilated, first a little shorter than second which is equal to fourth; a pronounced shovellike tubercle on base of first finger; all subarticular tubercles well developed; a fairly distinct axillar wing terminating the loose lateral folds of skin; toes one-third webbed, not dilated, with serrate dermal ridges along their sides, third longer than fifth and reaching to base of antepenultimate phalanx of fourth; a medium-sized shovellike inner metatarsal tubercle but no outer one; a heavy fringed dermal ridge of triangular points along outer side of tarsus to heel, continued as a prolongation of the ridge on outside of fifth toe; another inner tarsal ridge, similar but shorter, curving around the base of the shovellike tubercle. Body stout, in postaxillary region narrower than the very wide head; when hind leg is adpressed, heel reaches to posterior corner of eye; when limbs are laid along the body, knee and elbow touch; when hind legs are bent at right angles to the body, heels just fail to touch. Skin of central dorsal area fairly smooth except for two rows of warts paralleling the very conspicuous sinuous ridges emanating from the border of the eyelid, continuing over the tympanic area, nearly converging at the center of the back, diverging over the sacrum and meeting above the anus; several diagonal rows of granules, elongate glands, and triangular lobes on the sides of the body from the corner of the mouth to the groin; a very pronounced ridge of triangular lobes along outside of forearm, and other similar rows crossing top of tibia diagonally; venter finely granular everywhere, except for a few coarser granules below the anus. Traces of a skinfold across the throat, indicating a probable internal vocal sac.

Dimensions.—Head and body 38.5 mm.; head length 16.5 mm., width 20 mm.; femur 15.5 mm.; tibia 15.5 mm.; foot 16 mm.; hand 11 mm.

Color in alcohol.—Dorsum pale tan, with narrow black markings outlining some of the ridges and tubercles, especially those between the eyes and on sides of back; two wide brown diagonal bars across forearm and tibia above the rows of lobules, and traces of paler brown bars on upper and posterior femoral surfaces. Throat and chest dark brown, belly coarsely mottled with brown and buff; lower surfaces of legs buff, with a few small brown spots on the feet. Upper lip buff, with a dark blotch below the eye; tip of snout and horn sepia; a pale buff interorbital band followed by a dark brown occipital marking.

Remarks.—Another specimen from Rio de Janeiro, USNM 96948, is similar in proportions and pattern and is likewise spiny in appearance, due to the long lobules of skin on the legs and outer edges of arms.

The individuals of this species are seldom collected. Adults live under leaves and in stumps of tree ferns in mountain forests and feed upon crickets and small frogs, especially on young *Eleutherodactylus guentheri*. The voice is not known, and the eggs and young have not been observed.

Specimens examined

BRAZIL: KZAEM 701 (2), Fruhstrofer; BM 43.5.19.102.

MINAS GERAIS: Tunel, BM 1901.3.1.14, Robert.

MINAS GERAIS or ESPÍRITO SANTO: AMNH 38542, Kaempher, 1929.

RIO DE JANEIRO: Barrão H. de Mello, USNM 121320, IB 111, Instituto Butantan. Barreira, near Teresópolis, ZSBS 37/1947 (4), Bresslau, 1914. Campo Bello, Itatiaia, USNM 96948, Zikan, February 1924. Teresópolis, ZSBS 776/20, Bresslau, April 1914.

SANTA CATARINA: Humboldt, ZSBS 287/1920 (4), Erhardt, Nov. 10, 1918.

SÃO PAULO: ZSBS 628/1920, Weicke, 1913. Boracea, USNM 128147–9, Bokermann, Mar. 30, 1949. Piquete, BM 1907.7.29.20, Robert.

***Ceratophrys boiei* Wied**

PLATE 20, FIGURES G, H

1824. *Ceratophrys boiei* WIED. 1824b, p. 673 (type locality, Province of Bahia); 1824a, pl. 73, figs. 1, 2; 1825, pp. 569, 592.—DUMÉRIL and BIBRON, 1841, p. 437.—GÜNTHER, 1858, p. 25.—STEINDACHNER, 1867, p. 28.—BOULENGER, 1882a, p. 223; 1888c, p. 416.—BOETTGER, 1892, p. 29.—WANDOLLECK, 1907, p. 9.—BAUMANN, 1912, pp. 92, 161.—MIRANDA-RIBEIRO, 1920d, p. 292.—L. MÜLLER, 1922, p. 170; 1927, p. 268.—NIEDEN, 1923, p. 383.—MERTENS, 1930, p. 162.

1829. *Stombus boiei* GRAVENHORST, p. 50, pl. 9, figs. 1, 2.—MIRANDA-RIBEIRO, 1923f, p. 204, pl. 1; 1926, pp. 122, 213.—MELLO-LEITÃO, 1937, p. 342.

1829. *Ceratophrys granosa* CUVIER, p. 107 (type locality, Amérique méridionale);

1860. *Stombus granosus* FITZINGER, p. 415.

1862. *Ceratophrys bojei* REINHARDT and LÜTKEN, p. 157.

1901. *Ceratophrys dorsata boiei* Gadow, p. 215.
?1908. *Ceratophrys intermedius* Barbour, p. 323 (type locality, Santa Catarina, Brazil).
?1926. *Stombus intermedius* Miranda-Ribeiro, p. 123, pl. 13.

Description.—Adult female, USNM 97766, Valvera, Nova Friburgo, Rio de Janeiro. Vomerine teeth in two transverse, nearly contiguous series between the choanae; tongue nearly three-fifths the width of mouth-opening, cordiform, notched on its free posterior border; snout short and rounded when seen from above, slanting and concave in profile, the upper jaw projecting slightly beyond the lower; nostrils superior, projecting, situated at the end of the snout, their distance from each other a little less than their distance from eye. Canthus rostralis sharply marked off by a curved ridge; loreal region sloping, nearly flat, bounded by a slight ridge from nostril to lip and a heavier, wider one from anterior eye to lip. Eye large and prominent, anterolateral in position, its diameter about 1⅓ times its distance from nostril; interorbital diameter one-half the width of upper eyelid, which is prolonged into a dermal horn; three heavy glandular ridges beginning at the tip of this horn, the anterior meeting its fellow between the eyes, the middle one short and ending on the upper eyelid, the posterior prolonged backwards over the occiput and fading out behind the shoulders, becoming distinct again at the sacrum, where it converges above the anus. Tympanum not visible. Fingers free, with heavy, serrated, dermal ridges along their sides, their tips not dilated; first, second, and fourth subequal, their tips reaching to base of antepenultimate phalanx of third; tubercles at base of first finger and on palm large, bluntly pointed but not shovellike; other subarticular tubercles well developed; skin under arms loosely attached up to elbow, making an indistinct axillar wing; toes one-third webbed, not dilated, with serrate dermal ridges along their sides, third longer than fifth and reaching to base of antepenultimate phalanx of fourth; a medium-sized, shovellike, inner metatarsal tubercle but no outer one; a row of large tubercles along inside and outside of tarsus, and a similar but less distinct row along outer part of forearm. Body very stout, in postaxillary region a little wider than the head; when hind legs are adpressed, heel reaches to axilla; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are bent at right angles to the body, heels are slightly separated. Skin of back finely granulate, with rows of larger tubercles forming the ridges emanating from the eyelid already mentioned; a pair of heavy, curved bony ridges between and behind the eyes, and a shorter bony ridge directly behind the eye above the tympanic area; a few coarser tubercles irregularly scattered on upper lip and in the dorsolateral area, with indications of regular diagonal rows behind the axilla; upper surfaces of arms and legs with many pointed tubercles among the granules, some in rather regular arrangement following the crossbars; throat and chin very finely granular; remainder of lower surfaces coarsely granular, with a few heavier tubercles below the anus and a patch of elongate glands, almost striated in appearance, on the lower proximal parts of the femur.

Dimensions.—Head and body 73 mm.; head length 27.5 mm., width 33 mm.; femur 26 mm.; tibia 23 mm.; foot 26.5 mm.; hand 17 mm.

Color in alcohol.—Above light golden brown, with a marbled pattern of darker brown concentrating around the sinuous rows of glands along the back; a dark border to the white line coinciding with the glandular row connecting tips of dermal horns; some vertical dark patches on upper lip; arms and legs with wide brown crossbars; venter buff, with scattered coarse brown spots on belly; upper lip pale tan with a few indistinct darker patches, the largest of which comes beneath the eye.

Remarks.—In the specimens examined the first finger is about the same as the second in length, never appreciably longer. Miranda-Ribeiro specifically writes "pollegar egual ao indicador" in his 1920 report on frogs of this species in the Museu Paulista; it is difficult to see why his (1923f) key should give it as having the "primeiro dedo egual ao terceiro, maior que o segundo."

The described specimen has the glandular ridge from eyelid to coccyx entirely interrupted on the middle half of the back. A young frog, USNM 97767, taken near it has the ridge fully developed for the entire distance. These specimens have a pair of narrow brown diagonal bars with a light interspace beneath each eye. This same marking occurs in a specimen from Bello Horizonte, in one from Tijuca, and in one from Niterói. The second Niterói specimen, however, has a single, large, light brown spot covering the entire subocular area. This individual has also an interrupted dorsal ridge, while the others just mentioned have the ridge intact. The interorbital light bar is emphasized in some frogs by the presence of a heavy dark patch bordering it posteriorly, but in these two Niterói specimens and in the adult from Nova Friburgo this dark posterior patch is reduced to a small dot, so that the contrast is lacking.

The cry of this frog is *wah, wah, wah, wah.* It lives under leaves and stones high in the mountains. Eggs were found by Dr. A. Lutz in stagnant water under submerged leaves, laid in a round gelatinous mass. In the laboratory they hatched in 3 or 4 days into black tadpoles. It is not known how long before the metamorphosis is completed, but probably 5 or 6 months.

The status of *C. intermedia* Barbour can be settled only after a much larger series from Santa Catarina than is now available can be compared. The few characters mentioned by Barbour in his original description are all subject to a great deal of individual variation, especially the coloration. For instance, specimens from Bello Horizonte in Minas Gerais and from Salto in São Paulo have a white band joining the orbits and a very conspicuous brown spot below the eye. The young specimen from Nova Friburgo has a white band, while the adult female just described has a narrow white line between the eyes; both have a light brown, hardly conspicuous spot below the eyes.

Specimens examined

BRAZIL: MHNP 691, Langsdorff.

Districto Federal: Tijuca, USNM 96312, A. Lutz, March 5, 1934.

Minas Gerais: Bello Horizonte, USNM 96982, A. Lutz, December 1931. Rio Prêto, IB 14, Instituto Butantan.

Rio de Janeiro: ZSBS 64/47 (2), A. Lutz, 1925. Barra Mansa, IB 249. Barreira near Teresópolis, ZSBS 783/20 (4), Bresslau, February 1914. Campo Bello, ZSBS 220/25, A. Lutz, 1923. Capivary, IB 73. Niterói, USNM 96403–4, A. Lutz, September 28, 1923. Nova Friburgo, Valvera, USNM 97766–7, B. Lutz, Cochran, and Venancio, May 11, 1935.

Santa Catarina: Colonia Hansa, ZSBS 1/1915 (3), Schlüser, 1915. Joinville, ZSBS 76/25, Erhardt, 1907. Rio Humboldt, USNM 66584, November 1918. São Bento, USNM 121322–3; IB 17–19 and 22–24.

São Paulo: IB 223–5; ZSBS 629/1920, Weicke, 1913. Agua Quente, CM 2600, Haseman, November 28, 1908. Salto, USNM 121321; IB 25.

Ceratophrys cristiceps F. Müller

Plate 20, Figures i, j

1884. *Ceratophrys cristiceps* F. Müller, p. 279, pl. 5, figs. 1–1, c (type locality, Brazil).—Boulenger, 1903a, p. 69.—Baumann, 1912, p. 162.—Nieden, 1923, p. 385.—L. Müller, 1934a, p. 168.

1920. *Stombus cristiceps* Miranda-Ribeiro, 1920d, p. 302; 1926, p. 126.

Description.—Young female, USNM 121356, Diamantina, Minas Gerais. Vomerine teeth in two wide, well-separated, transverse series between the choanae; tongue about two-thirds as wide as mouth-opening, cordiform, with a deep notch on its free posterior border; snout very short, rounded when seen from above, truncate and slanting forwards in profile, the upper jaw scarcely projecting beyond the lower; nostrils superolateral, projecting, situated at the tip of the snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis blunt, but marked by a slight ridge extending backward from the nostrils; loreal region flat, sloping. Eye large, prominent, its diameter 1¼ times its distance from nostril; interorbital diameter less than width of upper eyelid, equal to interval between nostrils. Tympanum not visible. Fingers free, with a serrated ridge down the sides of each one, their tips not dilated, first slightly shorter than second, fourth longer than either; a pronounced shovellike tubercle at base of first finger; all subarticular tubercles well developed, the proximal ones showing a tendency to divide; a granular ridge along outside of forearm; no true axillar wing but skin of body attached nearly to elbow; toes webbed at the base, not dilated, with serrate dermal ridges, third a little longer than fifth and reaching to base of antepenultimate phalanx on fourth; a large shovel-shaped inner and a very small round outer metatarsal tubercle; a short serrate tarsal ridge curving outside the shovel-shaped metatarsal tubercle, and ending before it reaches the heel. Body very stout, in postaxillary region slightly wider than the head; when hind leg is adpressed, heel barely reaches to shoulder; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to the body, heels touch. Skin of upper surfaces finely granular, more heavily so on the sides where some of the larger granules are arranged in diagonal rows; middorsal area outlined with two sinuous rows of closely set granules beginning behind the eyes, converging towards the center of the back, diverging above the sacral region and coming together above the anus; upper eyelids and top of snout with coarse granules which form a fairly regular row on the outer edge of the eyelid and along the canthus to nostril; upper arm and leg surfaces finely granular; venter granular, with some coarser granules below the anus. Irregular folds of loose skin in front of groin and along the sides to the axilla.

Dimensions.—Head and body 29.5 mm.; head length 10 mm., width 12.5 mm.; femur 10 mm.; tibia 10 mm.; foot 10.5 mm.; hand 7.5 mm.

Color in alcohol.—Dorsum pearl gray, with a very distinctive pattern of brown spots on the back, the first of these between the eyes, and a second just posterior to it; three others on each side of the back, meeting the sinuous granular chain; lighter, more irregular markings continue along this chain of granules to the vent; upper lip with four large squarish spots on each side; an irregular brown patch from the tympanic area along the sides to the groin, but more or less interrupted posteriorly; granules below anus white, topping a round, pale buff area extending onto the belly and halfway down the femur, vaguely outlined by pale brown; upper tibia with three wide brown crossbars, and forearm with two similar ones; venter pale buff with fine, scattered, pale brown dots.

Remarks.—The small series from Diamantina, kindly loaned to me by the Instituto Butantan, were all very similar to the described specimen.

Specimens examined

BRAZIL:

Ceará: Ibiapaba, ZSBS 781/20, Snethlage, June 10–11, 1910. Ipú, ZSBS 782/20, Snethlage, 1910.

Minas Gerais: Diamantina, IB 510–15, Instituto Butantan.

Rio de Janeiro: BM 96.1.20.2, Greening.

Ceratophrys fryi Günther

Plate 20, Figure k

1873. *Ceratophrys fryi* Günther, p. 417 (type locality, Serra de Mantiqueira, Minas Gerais).—Boulenger, 1882a, p. 223, pl. 15, fig. 2.—Baumann, 1912, p. 161.—Nieden, 1923. p. 384.

1926. *Stombus fryi* Miranda-Ribeiro, p. 123, pl. 14, figs. 1–1,b.

Description.—Since no examples of this species have come to hand, the original description is reproduced here:

> No bony dorsal shield. Skin densely covered with small tubercles unequal in size; the two dorsal lines of tubercles, which are so conspicuous in *C. boiei*, are absent on the anterior and middle portions of the back, but represented by two short series commencing in the sacral region and converging into a point above the vent. Supraciliary horn long and pointed. The upperside of the head deeply concave, bordered on each side by a blunt-edged ridge terminating on the occiput, and in front by a rough prominent crest running from the eye to the nostril. Tympanum not visible. The vomerine teeth stand on a rather long transverse ridge slightly interrupted in the middle, between the choanae. Tongue much smaller than in *C. boiei*, not covering the bottom of the buccal cavity. Digits rather long, with the tubercles on the lower side much developed; carpus with three ovate flattish tubercles, the middle of which is a little larger than the outer. Metatarsal tubercle long, as long as its distance from the end of the inner toe; third toe rather longer than fifth. Web between the toes very short, but conspicuous.
>
> Upper parts brown, indistinctly marbled with darker. The upperside of the snout milk-white, the boundary between the brown and white being marked by a black line. Lower parts white, with irregular brownish-black spots.

	lines
Length of the body	35
Width between the angles of the mouth	16
Length of fore leg	23
Length of first finger	4⅓
Length of second finger	3¾
Length of third finger	5½
Length of hind leg	40
Distance between heel and end of fourth toe	18
Length of metatarsal tubercle	2¼

Ceratophrys ornata (Bell)

Plate 21, Figures a, b, e

1843. *Uperodon ornatus* Bell, p. 50, pl. 20, fig. 6 (type locality, Buenos Aires, Argentina).

1856. *Trigonophrys rugiceps* Hallowell, p. 298 (type locality, Rio Paraná); 1858, p. 367, pl. 36.

1858. *Ceratophrys ornata* GÜNTHER, p. 25; 1882, p. 222, pl. 46.—WEYENBERGH, 1876, p. 165.—BOULENGER, 1882a, p. 225.—F. MÜLLER, 1884, p. 279.—HUDSON, 1892, p. 79.—BERG, 1896, pp. 150, 165.—PERACCA, 1897, p. 16.—BUDGETT, 1899, pp. 305, 328.—GADOW, 1901, p. 216, figs. 43, 44.—BAUMANN, 1912, p. 93; 1917, p. 136.—NÁGERA, 1915, p. 24.—NIEDEN, 1923, p. 381.—MARELLI, 1924, p. 585; 1931, p. 199.—MIRANDA-RIBEIRO, 1926, p. 129; 1937a, p. 56.—MÜLLER and HELLMICH, 1936, p. 29, fig. 30.—MELLO-LEITÃO, 1937, p. 342.

1932. *Caratophrys* (sic) *ornata* B. LUTZ, p. 546, photograph.

Description.—Adult male, USNM 11383b, Rio de Janeiro. Vomerine teeth in two small distinct, widely separated patches on the inner anterior borders of the choanae; tongue large, cordiform, deeply notched on its free posterior border, about three-fifths as wide as mouth-opening; snout moderately long and rounded when seen from above, slanting forwards in profile; nostrils superior, a little farther from end of snout than from eye, slightly projecting, separated from each other by an interval equal to their distance from eye. Canthus rostralis ridged and straight, the ridges continued between the nostrils almost to lip border; loreal region concave, sloping outwards. Eye quite small, not very prominent, anterolateral, its diameter equal to its distance from nostril; interorbital diameter 1½ times the width of upper eyelid, a little greater than distance between nostrils. Tympanum distinct, separated from eye by an interval equal to 1½ times its greatest diameter. Fingers with a trace of web at their bases, with distinct dermal ridges along their sides, their tips not dilated, fourth and first subequal, both longer than second; a large, blunt, shovellike tubercle on base of first finger, and a larger but flatter one on palm; subarticular tubercles well developed; loose skin on sides forming an axillar wing and joining arm at elbow; toes nearly one-half webbed, not dilated, third slightly longer than fifth and reaching to base of antepenultimate phalanx of fourth; a sharp edged shovellike inner metatarsal tubercle, the outer one reduced to a small granule; a heavy blunt inner tarsal ridge extending from shovellike tubercle to heel. Body very stout, almost globular in shape, hence considerably wider in the postaxillary region than between the angles of the mouth; when hind leg is adpressed, heel reaches axilla; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels fail to meet. Skin of upper parts very rough, with numerous short, sharp edged glandular ridges emphasizing the centers of the dark dorsal spots, a median longitudinal one between the eyes, and two transverse ones following it being especially conspicuous, the areas of light skin between the ridged dark spots thickly covered with small pointed tubercles; a heavy ridge of bone leaving posterior part of eye and dividing to encircle tympanum; no pointed process, or horn, on upper eyelid, but instead a glandular rim on outer edge; upper parts of tibia and forearm with weak tubercles; venter slightly granular on throat, sides of body, and lower femur, fairly smooth on belly; glandules around anus larger and more pronounced than those on posterior femur. A pair of heavy humeral glands but no evidence of an external vocal sac.

Dimensions.—Head and body 92 mm.; head length 37.5 mm., width 54 mm.; femur 30.5 mm.; tibia 29 mm.; foot 35 mm.; hand 23 mm.

Color in alcohol.—Dorsum olive-gray, with numerous oval or irregular chocolate brown spots arranged in matched pairs down the back, the first pair kidney-shaped and located behind the eyes across the occipital region, followed by a large oval pair in the center of the back and an irregular crescentic pair on the sacrum; about a dozen medium-sized, oval, brown spots on the dorsolateral and lateral regions, with a few small spots mixed with them; femur and forearm similarly spotted above and posteriorly; two very wide brown crossbars on tibia and top of foot, and a brown spot on heel; upper lip with a wide rectangular spot from eye to lip border, with a round spot following this; a wide brown stripe below canthus extending across nostrils to upper lip border; venter buff, the chin and throat with very coarse brown spots, belly faintly mottled with dark; soles of feet and palms of hands brown, the digits lighter.

Remarks.—The only two Brazilian examples of this species were received in 1881 from "Rio de Janeiro" without indication as to whether the city or the state were meant. Their coloration and structural features agree with those from the Argentine and Uruguay in the U. S. national collection.

Specimens examined

BRAZIL:
  Rio de Janeiro: USNM 11383 a–b, Moran.
ARGENTINA: USNM 73525–7, A. and A. Breyer; MRHN IG 4544 Reg. 375g (10). Buenos Aires, USNM 12167 b–c; USNM 118816, Shippen. La Plata, USNM 22753. Lavalle, USNM 63502, 63504, Wetmore.
URUGUAY: Montevideo, MRHN IG 4544 Reg. 375.

Ceratophrys varia Wied

Plate 21, Figures c, d

1809. *Rana cornuta* (not of Linnaeus) Tilesius, p. 92, pl. 3.
1824. *Ceratophrys varius* Wied, 1824b, p. 673 (type locality not given).
1824. *Ceratophrys dorsatus* Wied, 1824a, pl. [59], [61], fig. 1; 1825, p. 576 (type localities, Rio Atabapouana and Lake Arará near Rio Mucuri).—Wagler, 1830, p. 204, pl. 22, figs. 1, 2.
1829. *Ceratophris varius* Cuvier, p. 106.
1829. *Ceratophris clipeatus* Cuvier, p. 106 (type locality, Amérique Méridionale).
1835. *Ceratophrys varia* Cocteau, pl. 8, fig. 2.—Fitzinger, 1843, p. 32.

1838. *Ceratophrys dorsata* Tschudi, p. 81.—Duméril and Bibron, 1841, p. 431 (part).—Günther, 1858, p. 24.—Peters, 1873a, p. 204.—Boulenger, 1882a, p. 225; 1885a, p. 195; 1886b, p. 440.—Cope, 1885b, p. 96.—Boldt, 1911, p. 111, pl. 8, fig. 1.—Baumann, 1912, p. 161.—Miranda-Ribeiro, 1920d, pp. 297, 303; 1923f, p. 201; 1926, p. 128, pl. 16, fig. 2.—L. Müller, 1922, p. 170; 1927, p. 268.—Nieden, 1923, p. 380.—Brazil and Vellard, 1926, p. 56, pl. 1.—Ditmars, 1929, p. 53, pl.—Mello-Leitão, 1937, pp. 331, 342, fig. 120.—Myers, 1946, pp. 11, 29.

1858. *Ceratophryne dorsata* Schlegel, p. 57.

Description.—Adult male, USNM 115606, State of Rio de Janeiro, Vomerine teeth in two small, slanting, widely separated patches on the inner border of the choanae; tongue rounded, very slightly indented on its free posterior border, about one-half the width of mouth-opening; snout fairly long, rounded when seen from above, sloping forwards in profile, the upper jaw slightly projecting beyond the lower; nostrils superior, scarcely projecting, situated on the sharply ridged, straight canthus rostralis three-fifths of the distance from snout tip to eye, separated from each other by an interval a little greater than their distance from eye; loreal region concave and sloping outwards. Eye quite small but prominent, anterolateral, its diameter equal to its distance from nostril; interorbital diameter 1½ times the width of upper eyelid (minus the horn), equal to interval between nostrils. Tympanum very distinct, separated from eye by an interval equal to 1¼ times its greatest diameter. Fingers free, with dermal ridges along their sides, their tips not dilated, fourth much longer than second, first slightly longer than second; two heavy rounded tubercles on palm and on base of first finger; toes webbed at the base, not dilated, fifth a little longer than third; a large shovellike inner metatarsal tubercle; outer tubercle greatly reduced in size; a very heavy inner tarsal ridge beginning above shovellike tubercle and ending before the heel. Body very stout, in postaxillary region as wide as the very broad head; when hind leg is adpressed, heel reaches to axilla; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are laid at right angles to the body, heels fail to meet. Skin of upper parts heavily glandular, with distinct ridges bordering the dark dorsal spots on the bony shield; blunt tubercles on posterior part of back and on the sides; venter nearly smooth, with faint glandular patches on sides behind axillae; a heavy, bony ridge along upper lip border, bifurcating below loreal region and sending its upper branch to the supratympanic region, lower branch continuing to corner of mouth; another less distinct ridge below eye, and another from nostril forward to upper lip ridge; eyelid with a single short dermal horn. No apparent skinfold across throat.

Dimensions.—Head and body 108 mm.; head length 47 mm., width 62 mm.; femur 40 mm.; tibia 36 mm.; foot 43 mm.; hand 32 mm.

Color in alcohol.—Dorsum slate-gray, with a pair of roughly crescentic dark brown spots behind the eyes extending across the lateral processes of the dorsal shield, and another pair outlining the posterior part of the shield; several irregular dark brown spots and bars on sides and posterior part of back, the most prominent being the one from the posterior tympanic border, fading out on the sides; a dark diagonal spot below eye; a large, somewhat triangular spot on the loreal region and in front of eye, and a dark streak along the ridge from nostrils to end of snout; posterior femur heavily marbled with brown on slate color, and upper femur and legs heavily marked by two wide, dark crossbands; a single dark crossband on forearm. Venter ochre yellow, the throat black.

Remarks.—The specimen from Guapi was kept alive for awhile. When disturbed the frog grunted *ah, ah, ah, ah* repeatedly in a harsh, low voice, and inflated its sides. Whenever a steel forceps or stick was presented, it leaped at once and seized the end with a good deal of vigor. When left undisturbed, it partly buried itself in the moss at the bottom of its cage.

The life history of the species has been recorded by Miranda-Ribeiro (1923). The collector Venancio says it is rarely found. It is sometimes called the *sapo boi* because its voice resembles the low bellow of an ox.

Specimens examined

BRAZIL: USNM 57506; USNM 89271.
Rio de Janeiro: USNM 115606–7, B. Lutz, 1938. Guapi, Teresópolis, USNM 97709, Sandig, April 1935.
Santa Catarina: Rio Humboldt, USNM 66585, November 1918.

Genus *Craspedoglossa* L. Müller

1922. *Craspedoglossa* L. Müller, p. 167. (Genotype *Craspedoglossa sanctaecatharinae* L. Müller.)
1926. *Craspedoglossus* Miranda-Ribeiro, pp. 49, 201; 1935, p. 416.—A. Lutz, 1929a, pp. 5, 17.

Generic diagnosis.—Pupil horizontal. Vomerine teeth. Tongue thick, set upon a heavy stalk, not protractile. Fingers and toes free, truncate at the tips. Omosternum a subulate cartilage. Sternum a cartilaginous plate, partly ossifying in the adult.

The abrupt widening of the maxillary bone anterior to the commissure of the jaws is a character which links this genus to *Ceratophrys*, *Zachaenus*, and *Cycloramphus*, while other similarities of these four genera in body form and proportions are quite apparent after examining a few specimens of each genus.

Zachaenus parvulus is distinguished from either of the two species of *Craspedoglossa* by its very loose lateral skin, which forms an axillary wing when the arm is placed at right angles to the body axis. No such loose skin is apparent in *Craspedoglossa*. The femur and tibia of *parvulus* are both significantly longer than those of *Craspedoglossa*.

Unfortunately the type of *Zachaenus roseus* Cope, USNM 15126, from Port Otway, Patagonia, is now macerated to a heap of fragments, so that the relationships of this species must remain uncertain until more specimens can be taken at the type locality.

***Craspedoglossa stejnegeri* (Noble)**

PLATE 21, FIGURES F–H

1924. *Borborocoetes stejnegeri* NOBLE, p. 68 (type locality, Organ Mountains, Brazil, 1,500 m.).

Description.—Redescription of male, USNM 52608 (type), Organ Mountains, Rio de Janeiro. Vomerine teeth in two short but heavy, narrowly separated patches behind the choanae; tongue one-half the width of mouth-opening, rounded, slightly free posteriorly; snout short and rounded when seen from above, sloping forwards to the lip border when seen in profile, the upper jaw not projecting beyond the lower; nostrils more lateral than dorsal, projecting, their distance from each other about two-thirds the interorbital diameter, nearer to end of snout than to eye. Canthus rostralis low, rounded; loreal region concave, sloping. Eye small, anterolateral in position, with a sinuous meniscus on upper border of pupil; diameter of eye nearly equal to its distance from end of snout; interorbital diameter 1⅓ times the width of the upper eyelid, a little greater than interval between nostrils. Tympanum small, faintly visible under the skin, separated from eye by a space equal to its own diameter. Fingers free, not dilated at the tips, the inside of first and both sides of second and third with lateral ridges of skin; first, second, and fourth subequal, reaching to base of penultimate phalanx of third; a rather pronounced pad at base of first finger; subarticular tubercles well developed on both hands and feet; no lateral skinfold along sides of body; toes not dilated, free, but with weak ridges of skin at least on the third, which is much longer than the fifth; a prominent oval inner and a smaller, round outer metatarsal tubercle; no tarsal ridge; body quite stout, in postaxillary region narrower than the very broad head; when hind leg is adpressed, heel reaches to commissure of jaws; when limbs are laid along the sides, knee and elbow just touch; when hind legs are laid at right angles to body, heels meet. Skin of upper parts fairly smooth, except for a few small pustules on upper eyelids behind eyes and on posterior part of the body and a faint Λ-shaped gland in the center of the back; a heavy but narrow fold leaving posterior corner of eye, encircling the tympanic area and ending behind mouth; venter smooth except for some slight granulations on the posterior surface of femur. A slight skinfold across the throat, but apparently no external vocal sacs.

Dimensions.—Head and body 47 mm.; head length 17.5 mm., width 21 mm.; femur 16.5 mm.; tibia 17 mm.; foot 20 mm.; hand 12 mm.

Mathematical analysis (in percentage of the total length):

	head length*	head width	femur	tibia	foot	hand
Number	5	5	5	4	5	5
Mean	38. 3	42. 5	38. 5	36. 5	43. 0	26. 0
Standard deviation	1. 86	1. 09	3. 96	1. 24	1. 85	3. 74
Variation	4. 9	2. 6	1. 03	3. 4	4. 3	6. 9
Standard error	. 83	. 49	1. 54	. 62	. 82	1. 67
Range	36. 5–41. 7	41. 7–44. 6	35. 0–45. 8	34. 6–37. 7	41. 7–46. 6	23. 1–33. 3

* To angle of jaws.

Color in alcohol.—Uniform light cinnamon brown above, with small spots on the sides; venter pale wood brown; throat suffused with dark cinnamon.

Variations.—The color of the Teresópolis specimen, USNM 121633, is as follows: Dorsum seal brown with Indian purple anteriorly, lightening posteriorly; a brown W-shaped mark across the shoulders, and a dark line between the eyes followed by a dark occipital patch. The belly and lower limb surfaces are pale olive-buff, the throat and sides of the body are coarsely mottled with brown, and some spots of this appear also on the anterior and posterior femur. A pale line borders the temporal ridge beneath; the remainder of the upper lip is dark brown like the top of the head. Tips of toes and fingers, as well as subarticular tubercles, are very pale olive-buff. The upper femur is crossed by two very dark narrow bars, continuing across the tibia and foot, when the legs are bent in the usual crouching position.

Remarks.—In the original description of this species, no mention was made of the fact that the maxillary bone widens greatly just anterior to the commissure of the jaws, a structural feature which increases the gripping power of the jaws, possibly due to cannibalistic habits.

In an attempt to fix the exact type locality, given only as "Organ Mountains," collected August 12, 1915, Dr. Rose's notebook was consulted in the Department of Botany in the U. S. National Museum. On August 11, 1915, Dr. Rose collected at Petrópolis. The entry for about 60 botanical specimens collected on August 12 is merely "Organ Mts. 1,000–1,500 meters." On August 14, he was at the Museu Paulista in São Paulo. It seems probable that the type locality of *C. stejnegeri* is some wayside station on the railway entering Petrópolis. This town has an elevation of 2,700 feet.

The type remained the only known specimen until the discovery in March 1945 of additonal examples at Teresópolis. A comparison of all these with examples of the southern *C. sanctae-catharinae* (Müller) from Rio Humboldt and Rio Novo (this latter a paratype), in Santa Catarina, and from Volta Grande, in Paraná, indicates that the foot of *C. stejnegeri* is significantly longer than that of *sanctae-catharinae.*

Specimens examined

BRAZIL:

Rio de Janeiro: Organ Mountains [probably near Petrópolis], USNM 52608 (type of *Borborocoetes stejnegeri* Noble), Rose, Aug. 12, 1915. Teresópolis, altitude, 1,000 meters, USNM 121633, Rodriguez, Venancio, and B. Lutz, March 1945; Lutz Coll. (3), B. Lutz.

Genus *Crossodactylodes* Cochran

1938. *Crossodactylodes* Cochran, p. 41. (Genotype, *Crossodactylodes pintoi* Cochran.)

Generic diagnosis.—The original generic diagnosis is reproduced, as follows:

> Outer metatarsals completely separated; sternum without a bony style; toes free; tips of toes and fingers dilated into regular disks which are not divided by a median groove, the terminal phalanx T-shaped; vomerine teeth represented only by a more or less roughened ridge; tongue oval, narrow, free posteriorly; tympanum hidden; pupil transversely elliptic.

Crossodactylodes pintoi Cochran

Figure 22

1938. *Crossodactylodes pintoi* Cochran, p. 42, (type locality, Macaé, Rio de Janeiro).

Description.—Adult male, USNM 102606 (type), Macaé, Rio de Janeiro. Vomerine teeth represented only by a more or less roughened ridge; maxillary teeth present; tongue oval, narrow, only one-third as wide as the mouth opening, free in its posterior half; snout flattened, short, extremely broad and rounded when viewed from above, in profile slanting forwards and downwards to the mouth-opening which lies beneath tip of the snout, so that the upper jaw projects scarcely at all beyond the lower; nostrils superior, appearing as minute, round holes on a level with the skin of the snout, their distance from end of snout about one-half that to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis scarcely evident, loreal region slightly concave and nearly horizontal because of the unusual flatness of the snout. Eye large, prominent, looking more forwards than sideways because of its position partly on the front instead of entirely on the side of the head, diameter of eye slightly less than its distance from tip of snout; pupil of eye small, oval in shape, transverse; inner eyeballs very prominent when mouth is opened; interorbital region depressed but flat, its diameter 1⅓ times that of the rather narrow upper eyelid, wider than the interval between the nostrils. Tympanum entirely hidden. Fingers short, thick, unwebbed, without dermal fringes, fourth much longer than second and reaching to base of disk of third; first finger extremely short and greatly thickened, its inner surface covered with a dozen heavy black spines set in a round mass confluent with the elongated swelling of the inner metacarpal tubercle; tips of fingers and toes enlarged into regular round disks a little wider than the preceding phalanx, without any trace of a median groove above or below; forearm and upper arm extremely well developed but short; toes short and thick, unwebbed, their disks distinctly larger than those of fingers, third toe longer than fifth and reaching nearly to disk of fourth; subarticular tubercles on fingers and toes reduced to indistinct rounded swellings; the outer metacarpal tubercle round and low, distinguishable mainly by position; inner metatarsal tubercle represented only by an oval swelling; outer metatarsal tubercle round, small but slightly more distinct; tarsus entirely smooth, without glandular lines; no dermal appendage on heel. Body heavily built, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches no farther than tympanic area; when limbs are laid along the sides, knee and elbow just touch; when hind legs are bent at right angles to body, heels touch. Skin everywhere coarsely granular and, under

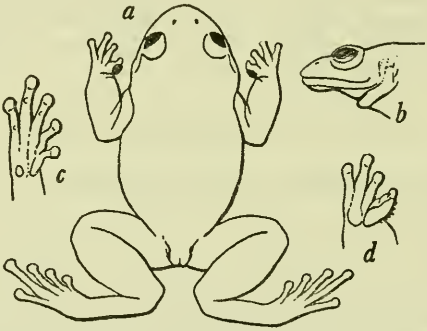


FIGURE 22.—*Crossodactylodes pintoi*, USNM 102606 (type): *a*, Dorsum × 2; *b*, profile × 2; *c*, foot × 2; *d*, hand × 2½.

the microscope, minutely glandular on upper and lower surfaces, except on throat and concealed limb surfaces, which are fairly smooth; no ridge above the tympanic area but a considerable swelling of the head behind it; a heavy bilobed projecting fold of skin above the anus, extending well over it, and a slighter one below the anus which is thus enclosed in a deep pocket of skin; no definite parotoid glands; two very heavy skinfolds across the throat, indicating a median external vocal sac.

Dimensions.—Head and body 17 mm.; head length 5.5 mm., width 7 mm.; femur 7 mm.; tibia 7 mm.; foot 6 mm.; hand 4 mm.

Color in alcohol.—Above pale immaculate wood brown, lighter below; disks of toes and fingers nearly white, spines black.

Variations.—In the six additional examples from the same locality, very little variation occurs. The peculiar anal pocket is more developed in some than in others, but is prominent in all. The smallest one, measuring 15 mm., does not have the posttympanic swellings, the full development seeming to occur only in adults. This individual is quite immature, having only one spine on the first finger, the number of spines in this species evidently increasing with age, as in the genus *Crossodactylus*. In one adult, spines are totally lacking. The others have 7–8, 7–9, 8–?, 9–9, respectively, while the type has 12–12, as stated. No true vomerine teeth are to be perceived in any of the specimens, but in all except the very young individual a slight roughness of the vomerine ridge can be felt with a sharp instrument. It would not be surprising if in a larger series a few individuals with a small patch of true teeth might be found, as this happens occasionally in the genus *Crossodactylus*, in which the tooth development seems to be similar.

Remarks.—The shape of the head and body of *Crossodactylodes* suggests that of *Zachaenus parvulus* much more than that of a *Leptodactylus*, but its true relationships are apparently not with the former because of its digital disks and its lack of definite, heavy vomerine teeth.

Its closest relationships seems to be with the genus *Crossodactylus*, since both genera have a very similar tooth development, and the patches of black spines on the inner surface of the first finger are nearly alike. *Crossodactylodes*, however, has all the digital disks round and without pads or furrow in the well-preserved specimens, while *Crossodactylus* has the pads and furrow always distinct on the upper surface of the toe disks, and usually on the finger disks as well. But when a toe of *Crossodactylodes* was dried out, a distinct difference in the tissue down the middle of the disk was observed; the edge shrank in so that the dried toe gave a bilobed appearance, indicating that the tissues inside are not homogeneous and that a foreshadowing of the condition found in *Crossodactylus* may here occur.

Cycloramphus ohausi (Wandolleck), from Petropolis, while a larger frog and probably a true *Cycloramphus* because of its inguinal gland, seems somewhat to suggest *Crossodactylodes pintoi* in its broad, depressed head and particularly in the presence of eight or nine spines on the first finger, a character not found in any other *Cycloramphus*. A thorough anatomical study is needed of all these forms to ascertain just how close is the relationship.

Specimens examined

BRAZIL:

Rio de Janeiro: Macaé, USNM 102606 (type), USNM 102607–11 (paratypes), and MP 104 (paratype), Museu Paulista.

Genus *Crossodactylus* Duméril and Bibron

1841. *Crossodactylus* Duméril and Bibron, p. 635. (Genotype, *Crossodactylus gaudichaudii* Duméril and Bibron.)

Generic diagnosis.—Tongue medium, oval, adherent everywhere, covered with irregular confluent folds. No palatine teeth. Tympanum distinct; Eustachian tubes very small. Fingers slender, weak, slightly depressed, completely free, dilated into disks which are convex below, flat above. Toes slightly flattened, enlarged in the same manner as the fingers and fringed on each side; outer tarsal border fringed. Transverse apophyses of sacral vertebra not dilated.

Crossodactylus gaudichaudii, the type species of the genus, is common near the city of Rio de Janeiro from whence the type presumably came. Most of the specimens have a white throat and chest, with at most a small gray longitudinal mark on the chest between the forearms. A more or less prominent dark longitudinal stripe begins at the nostrils, continues along the side of the head and in a few instances down the dorsolateral region halfway to the groin. The dorsum is a uniform gray or olive, except for a dull interorbital chevron-shaped darker marking, sometimes followed behind the shoulders by a)(-shaped pair of marks. The number of spines at the base of each first finger varies with age, reaching a maximum of six. The nostril lies between one-half and two-thirds the distance from eye to tip of snout.

A very closely allied form is *C. aeneus* from Teresópolis. In the series at hand, some of the characters supposed by Müller to distinguish it from *gaudichaudii* partly merge, since the snouts in both forms vary from rounded to angular-edged, and the width of the interorbital space varies. The nostril, said to lie closer to the tip of the snout in *aeneus,* shows little difference from an equal series of *gaudichaudii.* The lighter color pattern mentioned by Müller demonstrates itself only by the fact that the chevron-shaped interorbital mark is not usually followed in *aeneus* by the)(-shaped dark marks on the anterior part of the back. The hand spines do not number over 5 in any of the 25 examples at hand. The maximum total length is 30 mm.

The two foregoing species are grouped by the presence of a white throat, usually without reticulations or spots except for a small one in the center, as well as by the lack of a narrow, light dorsal line. It is true that the presence or absence of a dorsal line is not generally of much significance, as certain specimens may have it while others lack it arbitrarily, but here it appears to have some value as a color character, since the following forms, allied in other characters, usually have a light dorsal line as well.

The third form, *trachystoma* was first described by Reinhardt and Lütken from Lagôa Santa, near Bello Horizonte, in 1862, and was redescribed as *bresslaui* from Morro Velho, also near Bello Horizonte, by Müller in 1924. This form has a reticulated throat, on which nevertheless a median dark area is usually found. Its back is more highly patterned than is that of the first two species, since it has usually a prominent dark bar extending diagonally inwards from behind the eyes to the center of the back. The side of the head usually has a distinct dark line. Not more than four spines occur on the hand.

The fourth form, *dispar,* was described by Dr. Lutz in 1926. While in many ways it closely resembles *trachystoma,* notably in having a heavily reticulated throat, as well as in having a narrow light dorsolateral line, it differs slightly in lacking the dark stripe on the side of the head, and in having a greater degree of sexual dimorphism.

For a statistical analysis of measurements of the species of *Crossodactylus* here discussed, see pages 373 and 380.

Key to the species of Crossodactylus of southeastern Brazil

a.[1] Throat usually white with no reticulations or spots except for a small one in the center; no light middorsal line present.
  b.[1] Hand spines up to 6; a pair of)(-shaped dark marks on anterior part of back . . . . **gaudichaudii** (p. 248)
  b.[2] Hand spines up to 5; usually no)(-shaped dorsal marks; a light narrow dorsolateral line present . . . . **aeneus** (p. 244)
a.[2] Throat reticulated (having a median dark area, however); a prominent dark bar extending diagonally inwards from behind the eyes to center of back; a light dorsal line; hand spines not more than 4.
  b.[1] Side of head usually with a distinct dark line; hand spines up to 4. **trachystoma** (p. 252)
  b.[2] No dark stripe on side of head; a greater degree of sexual dimorphism than in *trachystoma:* hand spines usually 3, rarely 4 . . . . . **dispar** (p. 246)

The eggs of *Crossodactylus gaudichaudii*, apparently laid under leaves in water, have never been found, only the young tadpoles already swimming.

The adults have a very high call, *pip-pip-pip-pip* like that of a small chicken, but more rapid. They are found on leaves and under stones in mountain streams everywhere near the city of Rio de Janeiro, often associated with the tall semiaquatic plants called liros.

In the more than a hundred individuals of the four species which have served as the basis for these notes, some very interesting facts were observed in regard to the spines on the first finger (see table 1). In the 44 examples of *gaudichaudii* from Covanca, very young ones measuring only 13 to 15 mm. and with vestiges of the tail still unabsorbed showed one or two small black-tipped spines. At 18 mm. of length, three spines were often present, two in the group being larger and better-developed than the last which was just making its appearance. At 19 mm. four spines unequally developed were sometimes present. At 22 mm. five spines first appear, and no individuals under 26 mm. had the maximum number of six spines. About 16 percent of all individuals completely lacked the spines, without regard to size. Other frogs from other localities bear out these findings.

The series from localities near Teresópolis, supposedly representing *aeneus*, while having no very young individuals, shows in half-grown ones and adults the same correlation as to size and number of hand spines. None of the 26 had as many as six spines. Five spines, however, were not found in specimens measuring less than 26 mm., four spines occurred down to 24 mm., and three down to 18 mm.

The same observations hold good for the species supposed to have fewer spines, *dispar* (of which 28 examples, including three cotypes, are at hand) and *trachystoma* (26 examples).

The outer layer of the spine is apparently shed regularly at times, for in a few individuals which had fragments of loosened skin on the hands, the black coverings from the entire patch of spines could be lifted off with the skin, leaving the new spines as black and sharp as before.

Another peculiar characteristic of most males is the possession of a row of small spines, sometimes black-tipped, around the outer edge of the upper lip. They are evenly spaced, forming a single row almost concealed when the mouth is closed. Most frequently these spines are not black, being the same as the lips in color; in these cases they are hard to see, as they are almost microscopic in size. In the females the lip is either smooth or has a row of small spicules. In some males the spicules are equally poorly developed.

Table 1.—*Relation between number of thumb spines and total length in* Crossodactylus

Total length (mm.)	Number of spines						
	0	1	2	3	4	5	6
aeneus (26 specimens)							
13	oo						
14							
15							
16							
17							
18	o		oo	o			
19		ooo	oooo	o			
20			ooo	o			
21				oo			
22							
23				oo			
24	ooo	o		o	o		
25				o	o		
26				oo	ooo	o	
27					oo		
28				o	ooo	oooo	
29					o	o	
30							
31						oo	
32							
33				oo			
gaudichaudii (68 specimens)							
13			oo				
14		ooo	ooo				
15	o						
16	oooo		o	o			
17	oooo		o	o			
18			ooo	ooooo			
19		oo		oooo	oo		
20	oo		o	o			
21				o	o		
22	oo	oo		oo	o	o	
23	oo				o	ooooo	
24					oo	oo	
25	o			oo			
26	oooo			oooo	o	oooo	o
27			oo	o	ooo	oooo	
28	o			oooooooooo	ooo	ooooooooo	ooo
29				o	o	oo	oo
30					ooo	o	oo
31				ooo	ooo		
32				oo			
dispar (28 specimens)							
17	oo	oo					
18		oo					
19							
20							
21			oo				
22							
23			oo	oooo			
24		o		o			
25				ooooo	o		
26				oooo	oo		
27	oo		o	ooooo			
28				oooooooo			
29				oooooo			
30				oooo			
31			o	o			

Table 1.—*Relation between number of thumb spines and total length in* Crossodactylus—Continued

Total length (mm.)	Number of spines 0	1	2	3	4	5	6
				trachystoma (26 specimens)			
16	oo		oo				
17							
18							
19			oo				
20							
21		o		o			
22				oooo	oo		
23				ooooooooooo	o		
24				ooooooo	ooo		
25				oooooooooo			
26				oo			
27			o	ooo			

Crossodactylus aeneus L. Müller

Plate 22, Figures a, b

1924. *Crossodactylus aeneus* L. Müller, 1924a, p. 171 (type locality, Barreira, near Teresópolis, Rio de Janeiro); 1927, p. 272.

1931. *Crossodactylus gaudichaudii* (not of Duméril and Bibron) A. Lutz, pp. 228, 238.

Description.—Adult male, USNM 97692, Guapi, Teresópolis, Rio de Janeiro. A slight, continuous, V-shaped vomerine ridge in front of and between the choanae, with a few widely spaced toothlike projections; tongue a little more than one-half the width of mouth opening, oval, not notched or free posteriorly; snout rounded when seen from above and in profile, upper jaw extending considerably beyond lower; nostrils more lateral than superior, scarcely projecting, midway from eye to tip of snout, separated from each other by an interval equal to 1⅔ their distance from eye. Canthus rostralis distinct; loreal region vertical, the upper lip flaring slightly beneath it. Eye large and prominent, its diameter equal to its distance from end of snout; interorbital diameter 1⅓ times the width of upper eyelid, about four-fifths the distance between nostrils. Tympanum large and distinct, one-half the diameter of eye and separated from eye by an interval less than one-fifth of its own diameter. Fingers free, their tips slightly dilated, the median furrows not readily distinguishable on top of fingers, but very apparent on toes, fourth finger longer than second, reaching to antepenultimate phalanx of third; narrow marginal fringes along sides of fingers; a large oval palmar tubercle and a smaller one at base of first finger; a patch of five subequal, black spines on outer side of first finger; subarticular tubercles prominent, single; toes webbed at base, with wide lateral fringes and distinct terminal disks, third toe much longer than fifth, reaching base of penultimate phalanx of fourth, inner and outer metatarsal tubercles small but distinct, about equally developed; a wide dermal fold along inside of tarsus. Body stout, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels just touch. Skin of upper parts minutely glandular, with low tubercles on posterior sacral region and on upper tibia; a narrow supratympanic ridge extending to shoulder, and a heavy gland at posterior corner of mouth; ventral surface quite smooth; throat with a median fold indicating the presence of an external vocal sac. A furrow in the skin across chest between the axillae. Forearm moderately well developed.

Dimensions.—Head and body 31 mm.; head length 10.5 mm., width 10 mm.; femur 12.5 mm.; tibia 14 mm.; foot 14 mm.; hand 8 mm.

Color in alcohol.—Dorsum wood brown lightening to fawn posteriorly and on upper limb surfaces; a darker brown stripe on the side separates the dorsal color abruptly from the white underparts; femur with three diagonal wide brown bars separated by light areas, these continued onto tibia and foot, but fainter. Upper lip white, with a coarse dark brown reticulation. A white line from corner of mouth and shoulder, with a dark brown spot below it on side of throat. Venter white to pale buff, the throat with a median short dark longitudinal line.

Remarks.—Detailed studies of the life history of *Crossodactylus* from many localities may bring to light differences more significant than the very slight structural ones which may be made out by an examination of preserved material. While the snouts of many specimens of *C. gaudichaudii* appear angular in outline, many are bluntly rounded like a majority of those of *C. aeneus.* The interorbital diameter in *gaudichaudii* is usually greater than the width of the upper eyelid, but nearly as often equals the eyelid; in *aeneus* it usually equals the eyelid but is occasionally narrower, so that on this point only a few specimens from either locality show a positive difference. In about one-fifth of the examples of *aeneus*, the nostril is one-half the distance from eye to tip of snout; in the remaining examples the nostril is from two-thirds to four-fifths of the distance. In *gaudichaudii*, a little less than half the specimens have the nostril midway between eye and tip of snout, while the greater part have it from two-thirds to three-fourths that distance. The pattern, however, does show a more constant difference, as in *aeneus* it is confined usually to the head, while most *gaudichaudii* show some additional markings on the back. The dorsolateral fold is distinct, slight, or absent in *aeneus* as in *gaudichaudii*, and, in this instance, method of preservation is not a factor in making conspicuous the dorsolateral folds, because all of the 45 examples of *gaudichaudii* from Covanca, preserved simultaneously in the same preservative, show every condition of the dorsolateral fold.

Specimens examined

BRAZIL:

Rio de Janeiro: Barreira, near Teresópolis, ZSBS 2/1924, 45/47, 47/47, Bresslau, 1914. Colomi, Teresópolis, USNM 97726–8, Sandig, Apr. 10, 1935. Colonia Alpina, Teresópolis, BM 94.5.23.2, Goeldi. Guapi, near Teresópolis, USNM 97691–708, Sandig, March–April 1935. Petrópolis, USNM 101138, B. Lutz and Cochran, May 1935. Teresópolis, BM 93.12.22.9–13 Goeldi; USNM 96458–61, Lutz, Nov. 9, 1929.

***Crossodactylus dispar* A. Lutz**

Plate 22, Figures c–e

1923. *Crossodactylus gaudichaudii* (not of Duméril and Bibron) Miranda-Ribeiro, 1923c, p. 828.

1925. *Crossodactylus dispar* A. Lutz, 1925a, p. 138 (type locality, mountains of the State of Rio de Janeiro [actually from Bonito in the Serra da Bocaina]); 1926a, pp. 5, 12; 1931, p. 238.

1930. *Calamobates boulengeri* de Witte, 1930a, p. 219, pl. 1, figs. 2–2, b (type locality, Alto da Serra, São Paulo).

1931. *Crossodactylus fuscigula* (not of Fitzinger) A. Lutz, p. 238, pl. 65, figs. 14–16.

Description.—Adult male, USNM 96739 (cotype of *C. dispar*), Bonito, Serra da Bocaina, Rio de Janeiro. A very faint vomerine ridge slanting inwards from the anterior borders of the choanae; tongue very large, three-fourths as wide as mouth-opening, cordiform and with a deep notch on its posterior border; snout rounded when seen from above and in profile, the upper jaw extending considerably beyond the lower; nostrils superolateral, scarcely projecting, one-half the distance from eye to tip of snout, separated from each other by an interval equal to 1½ times their distance from eye. Canthus rostralis prominent but rounded, the loreal region slanting outwards, with a slight groove on its lower border where it meets the upper lip. Eye large and prominent, its diameter slightly less than its distance from end of snout; interorbital diameter less than width of upper eyelid, about two-thirds the distance between nostrils. Tympanum large and distinct, one-half the diameter of eye, separated from eye by an interval equal to three-fourths its own diameter. Fingers free, their tips very indistinctly dilated, with scarcely perceptible furrows separating two slight disks on top; second and fourth fingers subequal, reaching to base of penultimate phalanx of third; no trace of fringe on margins of fingers (in this specimen) but distinct ridges on toes; a large rounded palmar tubercle, and a similar one below the first finger; subarticular tubercles prominent, single; a patch of three large spines on outer side of first finger; toes scarcely webbed at the base, their disks small but better developed than those of fingers, having the two pads and furrow well visible; third toe much longer than fifth, reaching to base of penultimate phalanx of fourth; a sharp oval inner and a smaller rounded outer metatarsal tubercle; a wide dermal fold along inside of tarsus; body very stoutly built, in postaxillary region somewhat narrower than greatest width of head; when hind leg is adpressed, heel reaches to posterior corner of eye; when limbs are laid along the body, knee and elbow overlap; when hind legs are bent at right angles to body, heels just fail to meet. Skin of upper parts with short low glandular longitudinal swellings, a more prominent one from the posterior corner of the eyes diagonally directed towards the middle of the back and another making a fairly continuous chain of dorsolateral glandules, and another on the side from above the arm midway to groin; a few low tubercles on sacral region and below the dorsolateral glands; a slight ridge above tympanum, widening behind it and descending onto the shoulder where it ends in a slight swelling, with another gland in front of it at the corner of the mouth; ventral surface smooth except for a few postanal granules. No external vocal sacs, but forearm and upper arm greatly enlarged.

Dimensions.—Head and body 28 mm.; head length 9 mm., width 10 mm.; femur 13 mm.; tibia 13 mm.; foot 13 mm.; hand 7 mm.

Color in alcohol.—This specimen has now faded to an almost uniform cinnamon above, drab below. A faint, V-shaped, dark dorsal patch outlined with dark may be made out, its arms extending onto the posterior corners of the eyelids, and a faint line apparently extends above the tympanum.

Color in life.—Its living coloration was noted in the original description of *C. dispar* by Dr. A. Lutz (1925a), while its color pattern, together with that of the female, is shown on the plate accompanying his (1931) description of *C. fuscigula.*

Variations.—In two additional cotypes of *C. dispar*, USNM 96738 and 96740, the vomerine ridge is equipped with small, irregular teeth for most of its length. The circlet of black-tipped tubercles around the upper lip occurs in 96740, apparently a male. Among six topotypes the condition of the vomerine ridge is variable from serrate and toothed to smooth and scarcely perceptible. Dermal fringes on the toes may be well developed or lacking. The head and limb proportions are the same as those of *gaudichaudii,* while variation in other features is similar in extent to the latter.

The most apparent structural differences between male and female are the blunt snout and swollen head of the former, together with its greatly thickened forearm. The pattern of the male appears also to be less distinct, due to the darker ground color of the dorsum.

Specimens examined

BRAZIL:

MINAS GERAIS: Fazenda Cardoso, Serra de Capparão, USNM 97201–3, Aledron.

RIO DE JANEIRO: Angra dos Reis, USNM 70543–7, Metcalf, Oct. 15, 1925; MZUM 63343. Bonito, Serra da Bocaina, USNM 96738–40 (cotypes of *C. dispar*), A. Lutz, Jan. 20, 1925; USNM 96617, 96619, 96623–6, 96737, 96741, A. Lutz, 1930–34. Macieiras, Serra do Itatiaia, AMNH 17050–2, Holt, 1921. Montserrat, Serra do Itatiaia, AMNH 17064, Holt, 1921.

SANTA CATARINA: BM 88.4.23.11, Michaelis. Hansa, NMS (43), Erhardt; USNM 129368–77, Erhardt, 1928. Humboldt, ZSBS 676/20 (10), Erhardt, 1919. Itapocú, on the Rio Novo, BM 1928.11.5.16–72, Erhardt, March 1928. Rio Humboldt, USNM 66574, Fritsche, November 1918; BM 1923.6.1.33–5, Fritsche. Rio Novo, NHMB 2841, Erhardt, 1918–19; MZUM 58528.

SÃO PAULO: Alto da Serra, USNM 97825–30, Cochran and Venancio, Apr. 25–26, 1935; USNM 96853, A. Lutz, Jan. 25, 1924; MRHN IG 9404 Reg. 50 (type of *Calamobates boulengeri*), Massart, October 1922. Cruzeiro, BM 1901.3.1.19–23, Robert. Rio Tietê, CM 2603, Haseman, July 25, 1908. São Paulo, Orchid Gardens, USNM 97768–9, Cochran and Venancio, Apr. 24, 1935. Serra do Santos, USNM 96900, A. Lutz, Feb. 27, 1922.

Crossodactylus gaudichaudii Duméril and Bibron

PLATE 22, FIGURES F–H

1841. *Crossodactylus gaudichaudii* DUMÉRIL and BIBRON, p. 635 (type locality, Brazil).—GÜNTHER, 1858, pp. 23, 90.—FITZINGER, 1860, p. 414.—STEINDACHNER, 1865, p. 499; 1867, p. 52.—HENSEL, 1867, p. 149.—MIRANDA-RIBEIRO, 1923c, p. 828, pl., fig. K; 1926, p. 35, pls. 18, 19.—L. MÜLLER, 1927, p. 372.—A. LUTZ, 1931, p. 237, pl. 64, figs. 5–9.—NOBLE, 1931, pp. 113, 126, figs. 44,a, b.—PARKER, 1935, p. 509.—MYERS, 1946, pp. 10, 28.

1843. *Limnocharis fuscus* BELL, p. 33, pl. 16, figs. 3, 3,a (type locality, Rio de Janeiro).

1853. *Elosia vomerina* GIRARD, p. 423 (type locality, Rio de Janeiro); 1858, p. 69, pl. 4, figs. 26, 39.—BOULENGER, 1882a, p. 194.—NIEDEN, 1923, p. 404.—A. LUTZ, 1931, p. 233.

1860. *Phyllobates fuscigula* FITZINGER, p. 414 (nomen nudum).

1862. *Leptodactylus gaudichaudii* BOULENGER, 1882a, p. 249; 1888c, p. 416.—WERNER, 1894a, p. 413.—BAUMANN, 1912, p. 162.—NIEDEN, 1923, p. 490, fig. 335.—MIRANDA-RIBEIRO, 1927, p. 114.

1926. *Grossodactylus* [sic] *vomerinus* MIRANDA-RIBEIRO, p. 34 (part).

1930. *Phyllobates brasiliensis* DEWITTE, 1930a, p. 217, pl. 1, figs. 1, 1,a (type locality, Cachoeiras, Rio de Janeiro).

1931. *Basanitia lactea* (not of Miranda-Ribeiro) A. LUTZ, p. 240, pl. 65, fig. 19 (specimens from Serra da Piedade, USNM 96391).

Description.—Adult male, USNM 97496, Covanca, Jacarépaguá, near the city of Rio de Janeiro. Vomerine teeth represented by two very small patches between the choanae at the inner ends of the ridges which extend outward to the anterior borders of the choanae; tongue half as wide as mouth-opening, broadly oval, with a slight indentation on its nearly attached posterior margin; snout bluntly pointed when seen from above, slanting backwards to the upper lip in profile, the upper jaw extending far beyond the lower; nostrils lateral, scarcely projecting, about three-fifths the distance from eye to tip of snout, separated from each other by an interval equal to 1⅓ times their distance from eye. Canthus rostralis prominent but rounded, the loreal region vertical, with a slight groove on its lower edge where the upper lip projects slightly outwards. Eye large and prominent, its diameter equal to its distance from end of snout; interorbital diameter equal to width of upper eyelid, about three-fourths the distance between nostrils. Tympanum large and very distinct, one-half the diameter of eye, separated from eye by an interval equal to one-third its own diameter. Fingers free, their tips very slightly dilated into disks which all have a pair of rather indistinct pads divided by a faint median longitudinal furrow on top and a transverse groove across the upper part of the joining between the last two phalanges; second and fourth fingers subequal, reaching to base of penultimate phalanx of third; a wide dermal fringe on the margins of fingers and toes; no pronounced pollex, but a rounded palmar tubercle and another below first finger; subarticular tubercles single, prominent; a patch of five or six small black spines on the outer side of first finger; toes webbed at the base, their disks with very prominent pads and a median furrow; the transverse groove across upper part of toe between each two terminal phalanges followed by a pad, causing the terminal phalanx of toes as well as fingers to bend forward (in a preserved specimen) at a right angle to remainder of digit; third toe much longer than fifth, reaching to base of penultimate phalanx of fourth; a sharp oval inner and a smaller round outer metatarsal tubercle; a wide dermal flap along inside of tarsus; body stoutly built, in postaxillary region a little wider than greatest width of head; when hind leg is adpressed, heel reaches to between eye and nostril; when limbs are laid along the body, knee and elbow overlap; when hind legs are bent at right angles to body, heels just touch. Skin of upper parts quite smooth anteriorly, a few scattered tubercles appearing on the sacral region and becoming more concentrated on the sides; a slight ridge encircling the upper part of tympanum and ending above the shoulder in a low glandular swelling with a large gland in front of it behind corner of mouth; ventral surface smooth except for a small granular postanal patch. No external vocal sacs, but forearm and upper arm greatly enlarged.

Dimensions.—Head and body 29 mm.; head length 11 mm., width 10.5 mm.; femur 14 mm.; tibia 14 mm.; foot 14 mm.; hand 7.5 mm.

Color in alcohol.—Head and back uniform slate-gray above; a white spot on the posterior corner of eyelid, and another on the large gland behind the corner of the mouth; most of the tubercles on the sides light, a pale diagonal white stripe just in front of groin; three wide, dark, rectangular spots separated by white interspaces on upper surface of femur; tibia with similar but less distinct dark spots; anterior and posterior surfaces of femur with small dark dots which partly anastomose to form slight reticulations; upper surfaces of arms and feet drab with confused darker marblings; ventral surface pale buff, immaculate except for a few gray spots across the throat, concentrating into a short dark longitudinal stripe on the center of the throat.

Color in life.—Four examples, USNM 97420–3, served as a basis for color notes. Middorsal area and head bister to olive, posteriorly darkened. Lateral regions Indian purple with lighter spots of olive-buff. Ventral parts white with a cloudy mottling on the throat. Limbs broccoli brown barred with clove brown. Iris gold, pupil black. Spines on thumb black. A prominent white glandular stripe behind ear. The smallest one is more greenish, with olive-green above, lower surface of legs pale olive-yellow, and very pale mottling over entire undersurface.

Variations.—This species is subject to a great deal of variation in many of the characters which as a rule show some stability. In the matter of vomerine teeth, for instance, all trace of any may be lacking, or there may be a well-defined but toothless ridge curving inwards from the anterior borders of the choanae, or there may be a small but distinct patch of four or five teeth at the inner end of this ridge between the choanae. The dermal fringes on the toes and fingers may be present and developed to a high degree, or they may exist only as a ridge along the sides of the digits, or they may be entirely lacking. The third toe varies in relation to the fourth, its tip sometimes extending to the base of the penultimate phalanx of the fourth, sometimes only half-way up on the antepenultimate. A dorsolateral fold may be distinctly present, but is often very slight and may be lacking. The interorbital diameter, usually greater than the width of the upper eyelid, is sometimes equal to it. The nostril in half the specimens is midway between eye and tip of snout; in the rest about two-thirds the distance from eye to snout. The snout may be rounded, but usually has four distinct slants, that from eye to nostril on each side and a very wide obtuse angle at the tip. The head length averages 37 percent of the total length (range, 32 to 42) and the tibia about 49 percent (range, 42 to 55). The adpressed heel reaches to the anterior corner of the eye, and sometimes nearly to the nostril, while the hind leg measured from groin to tip of toe is about 1½ times the head and body length. The skin is fairly smooth on the dorsum, but often with small pointed tubercles on the sides. The warty appearance is still further increased by the presence of encysted *Cercaria* or other ectoparasites which frequently infest both this genus and *Elosia*.

While a great many of the specimens have a white throat with no markings except a short, median, dark longitudinal spot, about one specimen in ten has a reticulated dark pattern all over the throat, and it was possibly this unusual color pattern to which Fitzinger applied his name of *Phyllobates fuscigula* instead of to a different species, as Dr. Lutz thought (1931, p. 227).

In about three-fourths of the specimens a dark longitudinal line appears above the tympanum, in a few cases extending along the dorsolateral region for a short distance. The top of the head usually shows a fairly prominent, broad, dark, interorbital bar, with a blurred, dark, V-shaped one immediately following from the posterior corners of the eyes, while the back sometimes shows an indistinct W- or)(-shaped mark, the whole pattern being often nearly blended with the dark dorsal ground color. The pale stripe in front of the groin is fairly constant in most examples.

Remarks.—The reference by Beebe (1919, p. 209) to an example of *gaudichaudii* Duméril and Bibron from Bartica District, British Guiana, must have been due to misidentification, as this genus is confined to Brazil. The specimen unfortunately has disappeared from the collections of the New York Zoological Society and so I have been unable to examine it. Noble (1931, p. 113) states, "In *Crossodactylus gaudichaudii* the second finger of the male is spatulated." I do not find that the second is any more enlarged, i. e., "spatulated," than the fourth or third fingers in well-preserved male specimens or in females. The degree of enlargement of the finger and toe disks varies considerably in individuals, even in those taken at the same time and place.

Specimens examined

BRAZIL: MHNP 746 (2; cotypes of *C. gaudichaudii*), Gaudichaud.

Districto Federal: Covanca, Jacarépaguá, USNM 97495–539, Cochran, Dias, and Venancio, Feb. 7, 1935. Gavea, BM 1910.5.4.12–17, Bannerman. Recreio dos Bandeirantes, USNM 97629, B. Lutz, Cochran, and Venancio, Feb. 10, 1935. Rio de Janeiro: USNM 15481–2 (cotypes of *Elosia vomerina*), U. S. Exploring Expedition, 1837; USNM 50602, Rose, July 1915; USNM 70548–50, Metcalf, Oct. 11, 1925; USNM 81155–8, A. Lutz, 1930; MZUM 68768 (2), A. Lutz, August 1930; BM 45.5.25.8 (type of *Limnocharis fuscus*), Charles Darwin; NHMW (10), Steindachner, January 1874; ZSBS 26/47, A. Lutz, 1923; ZSBS 46/47, Bresslau, January 1914. Avenida Niemeyer, USNM 97468–9, Cochran, Dias, and Venancio, Feb. 7, 1935. Paineras, slope of Corcovado, USNM 97442–3, B. Lutz and Cochran, Jan. 27, 1935. Pico de Tijuca, MZUM 104240–1, 104243 (2), Bailey, 1941; USNM 52604, Rose, Aug. 9, 1915; USNM 96268–70, A. Lutz, 1923; USNM 97420–3, A. Lutz, Cochran, and Venancio, Jan. 21, 1935.

Minas Gerais: Passa Quatro, USNM 96920, A. Lutz, February 1930.

RIO DE JANEIRO: Barreira, near Teresópolis, ZSBS 26/47, A. Lutz, 1923. Barro Branco, MZUM 104262, Bailey, 1941. Cachoeiras, MRHN IG 9404 Reg. 79 (2; cotypes of *Phyllobates brasiliensis*), Massart, Nov. 27, 1922. Teresópolis, ZSBS 285, Bresslau, February–March 1929.

Crossodactylus trachystoma **(Reinhardt and Lütken)**

PLATE 22, FIGURES I, J

1862. *Tarsopterus trachystomus* REINHARDT and LÜTKEN, p. 177, pl. 3, figs. 2, 2a (type locality, Lagôa Santa, near Bello Horizonte, Minas Gerais).
1923. *Leptodactylus gaudichaudii* (part) NIEDEN, p. 490, fig. 335.
1924. *Crossodactylus bresslaui* L. MÜLLER, 1924a, p. 169 (type locality, Gorduras, near Villa Nova Lima, Minas Gerais); 1927, p. 273.

Description.—Adult female, USNM 98017, roadside between Morro Velho and Bello Horizonte, Minas Gerais. A slight vomerine ridge in front of and between the choanae; tongue large, about two-thirds the width of mouth-opening, oval but not posteriorly notched; snout rounded when seen from above and in profile, the upper jaw extending greatly beyond the lower; nostrils more lateral than superior, scarcely projecting, two-thirds the distance from eye to tip of snout, separated from each other by an interval equal to 1¼ times their distance from eye. Canthus rostralis distinct, the loreal region slanting outwards, slightly grooved along its lower border where it meets the lip. Eye large and prominent, its diameter equal to its distance from end of snout; interorbital diameter equal to width of upper eyelid, about two-thirds the distance between nostrils. Tympanum large and distinct, one-half the diameter of eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, their tips slightly dilated, the median furrows visible in this specimen on top of third and fourth fingers; second and fourth fingers subequal; narrow marginal fringes along sides of fingers; a large round palmar tubercle and a smaller one on lower base of first finger; two larger and one smaller black spines on outside of first finger; subarticular tubercles prominent, single; toes webbed at base, with small but well-developed disks, having a furrow dividing the upper surface visible on all except the inner one; third toe much longer than fifth, reaching to base of penultimate phalanx of fourth; a prominent conical inner metatarsal tubercle and a smaller outer one; a wide dermal fold along inside of tarsus, and smaller dermal ridges on sides of toes. Body stout, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the body, knee and elbow meet; when hind legs are placed at right angles to body, heels slightly overlap. Skin of upper parts minutely glandular, with numerous tubercles along the sides and on sacral region; a prominent supratympanic ridge, and a swollen area above it behind the eye; ventral surface quite smooth. A slight wrinkling of throat skin may indicate the presence of a small external vocal sac; upper arm and forearm very well developed.

Dimensions.—Head and body 27 mm.; head length 9 mm., width 9.5 mm.; femur 12 mm.; tibia 12.5 mm.; foot 12 mm.; hand 7 mm.

Color in alcohol.—Dorsum light fawn color, with a few small darker spots scattered over back; upper lip immaculate cream, except for a dark spot on anterior border of tympanum; femur with two or three faint darker crossbars, extending onto tibia and foot; throat pale cream with fine darker reticulations; rest of ventral surface pale.

Remarks.—This form is well separated geographically from the three others, but is closely allied to all of them nevertheless. It has a broad and rounded snout, in this feature suggesting its relationship to *dispar* and *aeneus;* its highly reticulated throat again suggests *dispar*, while separating it from *aeneus* and *gaudichaudii.* The difference in sex in *trachystoma* is not marked, and the general form of the body seems more slender than in *dispar*.

Specimens examined

BRAZIL:

Minas Gerais: Bello Horizonte, Country Club, USNM 97891, Cochran and Venancio, Mar. 13, 1935. Lagôa Santa, UZMK 128 (type of *Tarsopterus trachystomus*) Reinhardt; UZMK 129, Warming; BM 67.7.8.10, Reinhardt. Morro Velho to Bello Horizonte, USNM 98017–9, Cochran and Venancio, Mar. 13, 1935. Morro Velho to Lagôa Grande, USNM 98014–5, Cochran and Venancio, Mar. 16, 1935. Ouro Prêto, USNM 98047–57, 98059–65, Cochran, Dias, and Venancio, Mar. 18–19, 1935. Rio Doce, CM 2662–3, Haseman, May 25, 1908.

Genus *Cycloramphus* Tschudi

1838. *Cycloramphus* Tschudi, p. 81. (Genotype, *Cycloramphus fulginosus* Tschudi.)
1858. *Pithecopsis* Günther, p. 22.
1867. *Grypiscus* Cope, p. 205.
1889. *Cophaeus* Cope, pp. 312, 381 (for *Telmatobius* of Boulenger, not of Weigmann).
1920. *Iliodiscus* Miranda-Ribeiro, 1920b, p. 267.

Generic diagnosis.—Pupil horizontal. Tongue oval, entire and free behind. Vomerine teeth present. Tympanum hidden. Fingers free; toes webbed, the tips not dilated. Outer metatarsals separated. Omosternum cartilaginous; sternum a cartilaginous plate. Terminal phalanges, simple.

The city of Rio de Janeiro was the type locality for specimens on which two much-disputed specific names have been based, Steindachner's *Telmatobius brasiliensis* and Cope's *Grypiscus umbrinus.*

The material at hand proves definitely that there are at least three species of the genus *Cycloramphus* found in or within a very short distance of the city of Rio de Janeiro. One, with a smooth skin and toes entirely devoid of webs, was not known to early authors; it was named *Iliodiscus eleutherodactylus* by Miranda-Ribeiro in 1920. Two others have distinct webs on the toes and skin that may be smooth or granular according to individual variation. Of these, one has a fuller web and much longer legs, the adpressed heel reaching beyond the tip of the snout, its tibia being between 53 and 56 percent of the total length. This seems to be the species designated by Steindachner in 1864 as *Telmatobius brasiliensis*, but at that time already properly bearing the name of *Cycloramphus fulginosus* Tschudi (given as *fuliginosus* by Duméril and Bibron in 1841). The last species has a distinctly shorter web on the hind feet, with a considerable part of the fourth toe left free. It has very short legs, the adpressed heel reaching only to between the posterior and anterior corners of the eye, its tibia being 44 to 49 percent of the total length of head and body. This species is considered to be that designated by Cope as *Grypiscus umbrinus*, which Dr. Lutz (1929a) mentioned and figured as *Cyclorhamphus fuliginosus* and to which Miranda-Ribeiro (1929b) applied the new name of *Iliodiscus lutzi*.

Although Miranda-Ribeiro (1935) put his *Iliodiscus dubius* from Alto da Serra into the synonymy of *brasiliensis* of Steindachner, *dubius* appears to belong to the synonymy of *Cycloramphus asper* Werner. On comparing the numerous frogs from Alto da Serra with the Rio de Janeiran examples of *fulginosus* (=*brasiliensis*) it may be immediately noted that the former have heavily tubercular skins and that the toes are webbed only at the base, while in *fulginosus* from Rio de Janeiro the skin is at most slightly granular, and the webs extend nearly to the tips of the toes. The shape of the head and body is very similar in these frogs and without seeing examples from both localities side by side it would be quite easy to confuse them.

The full range of variation in the several species making up this genus is still only partly known, and additional material from Minas Gerais, Rio de Janeiro, São Paulo, and Santa Catarina must be gathered and compared with the existing types before an adequate revision is possible.

For a statistical analysis of measurements of the species of *Cycloramphus* here discussed, see pages 373 and 381.

Key to the species of Cycloramphus of southeastern Brazil

*a*¹. Spines on thumb . . . . **ohausi** (p. 264)
*a*². No spines on thumb.
  *b*¹. Hind feet webbed.
    *c*¹. Toes more than two-thirds webbed.

- d^1. Webs reaching to tips of toes; heel reaching beyond snout; skin slightly tubercular . . . . **fulginosus** (p. 259)
- d^2. Toes three-fourths webbed, or slightly less; heel reaching to nostril or slightly beyond, or only to center of eye . . . . . **neglectus** (p. 262)

c^2. Toes one-half webbed or less.

- d^1. Heel reaching to posterior corner of eye; skin finely granular; toes one-half webbed or a little less . . . . **umbrinus** (p. 266)
- d^2. Heel reaching beyond tip of snout; skin tubercular; toes webbed only at base . . . . **asper** (p. 255)

b^3. No webs on hind feet.

- c^1. Back densely covered with large granules or warts . . **granulosus** (p. 261)
- c^2. Back smooth . . . . **eleutherodactylus** (p. 257)

Cycloramphus asper Werner

Plate 22, Figures K, L

1899. *Cyclorhamphus asper* Werner, 1899b, p. 482 (type locality, Santa Catarina, Brazil).—L. Müller, 1922, p. 171.—Nieden, 1923, p. 368.—Noble, 1926a, p. 14.—A. Lutz, 1928, p. 640.—Barbour and Loveridge, 1929, p. 247.—Bokermann, 1951, p. 82, figs. 1, 1a, 13, 17, 21, 27.

1914. *Telmatobius duseni* Andersson, p. 1 (type locality, Ipiranga, Serra do Mar, Paraná).—Nieden, 1923, p. 375.

1920. *Cycloramphus duseni* Barbour and Noble, p. 407.

1920. *Iliodiscus dubius* Miranda-Ribeiro, 1920b, p. 268, pls. 1, 2, 3 (part) (type locality, Alto da Serra, São Paulo).

1920. *Iliodiscus pinderi* Miranda-Ribeiro, 1920b, p. 269, pls. 3 (part), 4, 5 (part) (type locality, Serra de Macaé, Rio de Janeiro); 1926, p. 48, figs. 27, 28; 1929b, p. 14.

1920. *Iliodiscus semipalmatus* Miranda-Ribeiro, 1920b, p. 269, pls. 3, 5, 6 (type localities, Campo Grande and Alto da Serra, São Paulo); 1926, p. 48, pl. 6, figs. 1–1, b; 1929b, p. 16.—Barbour and Loveridge, 1929, p. 284.—deWitte, 1930a, p. 222.

1923. *Niedenia spinulifer* Ahl, p. 107 (type locality, East Africa [in error]).

1925. *Grypiscus pinderi* Barbour, p. 8.—Miranda-Ribeiro, 1935, p. 415.

1925. *Grypiscus dubius* Barbour, p. 8.

1926. *Iliodiscus asper* Miranda-Ribeiro, p. 47, fig. 26; 1929b, p. 15.

1929. *Cyclorhamphus pinderi*, A. Lutz, 1929a, p. 10.—B. Lutz, 1947, p. 246.

1935. *Grypiscus asper* Miranda-Ribeiro, p. 416.

1935. *Grypiscus duseni* Miranda-Ribeiro, p. 416.

1951. *Cycloramphus pinderi* Bokermann, p. 84, figs. 3, 3a, 12, 15, 25, 28.

1951. *Cycloramphus dubius* Bokermann, p. 85, figs. 7, 7a, 8, 8a, 9, 18, 24, 31.

Description.—Adult male, USNM 97841, Alto da Serra, São Paulo. Vomerine teeth in two short, transverse, nearly contiguous patches behind the choanae; tongue two-thirds as wide as mouth-opening, rounded, with a very slight posterior indentation, attached behind; a small toothlike process on anterior border of lower jaw; snout very bluntly rounded, sloping forward to upper lip, which does not project much beyond the lower jaw; nostrils small, nearly superior, in a low nasal elevation, separated from each other by an interval equal to their distance from eye. Canthus rostralis scarcely evident; loreal region slightly concave and sloping outwards towards the flaring upper lip. Eye large, prominent, its diameter 1½ times its distance from nostril, a little less than its distance from end of snout; interorbital diameter equal to width of upper eyelid, equal to distance between nostrils. Tympanum not visible. Fingers moderately long, free, with distinct lateral ridges, their tips ending in ball-shaped disks which are not enlarged; second and fourth subequal, reaching to base of penultimate phalanx of third; a slight elongate wartlike rudiment of a pollex, and two larger palmar tubercles; toes webbed only at the base, with fringes along their sides, their tips also rounded but not wider than the preceding phalanx, third longer than fifth, reaching halfway to base of penultimate phalanx of fourth; a prominent elongate inner and a very small round outer metatarsal tubercle; subarticular tubercles on feet and hands very well developed; a faint inner tarsal ridge. Body broadly elliptical in shape, in postaxillary region a little narrower than the head. When hind leg is adpressed, heel reaches slightly beyond tip of snout; when limbs are laid along the sides, knee and elbow overlap considerably; when hind legs are bent at right angles to body, heels meet. Skin of upper parts heavily tuberculated, with elongate glandular ridges prominent between the shoulders and on the back; a slight dermal ridge from posterior corner of eye to angle of mouth; a large round inguinal gland in the groin in the male; ventral surface minutely pitted with glandules, but not granular except around the anus. No skinfold across chest or belly, and apparently no external vocal sac in the male.

Dimensions.—Head and body length 35 mm.; head length 15 mm., width 15.5 mm.; femur 17 mm.; tibia 18.5 mm.; foot 17 mm.; hand 9.5 mm.

Color in alcohol.—Dorsum light wood brown, with a lighter band between the eyes, followed by a darker triangle; an indistinct reticulation of sepia outlining the heavy dorsal glandular ridges; femur and tibia with two wide, dark, diagonal bars; venter cream color, with a sprinkling of very fine tawny dots on the chin. Posterior femur cream color with indistinct tawny reticulations.

Remarks.—This species is very common in the biological reserve at Alto da Serra, living among rock piles along the mountain streams. Some from this place were sent to H. W. Parker, British Museum (Natural History), who wrote on June 7, 1937 that they "agree with our specimens from the same locality and with a cotype of *C. duseni* Andersson. I believe this is neither more nor less than *C. asper* Werner, so that *duseni* and *semipalmatus* should be regarded as synonyms. This, I believe, was Lutz' view." Barbour (1925, p. 8) regarded *semipalmatus* as *umbrinus*, after comparing it with the type of the latter.

Specimens examined

BRAZIL:

Rio Grande do Sul: Santa Maria, USNM 121318.

Santa Catarina: MHNP 31–48.

São Paulo: Alto da Serra, USNM 96820–35, A. Lutz, 1922–26; USNM 97841–6, Cochran and Venancio, Apr. 25–26, 1935; BM 1930.3.8.1–2, Massart; MRHN IG 9308, Reg. 46 (10), Massart, 1922. Cubatão, CM 2466, Haseman, Aug. 1, 1908. Iguapé; CM 2610, Haseman, Dec. 16, 1908. Rio Grande, IB 27–36. Serra de Cubatão, MCZ 1582; USNM 81142–3, A. Lutz, Feb. 12, 1923.

Cycloramphus eleutherodactylus (Miranda-Ribeiro)

Plate 2, Figures a, b

1920. *Iliodiscus eleutherodactylus* Miranda-Ribeiro, 1920b, p. 270, pl. 5 (part) (type localities, Alto da Serra and Rio Grande, São Paulo); 1926, p. 49, pl. 6, figs. 2–2,b; 1929b, pp. 17, 31.

1925. *Grypiscus eleutherodactylus* Barbour, p. 8.—Miranda-Ribeiro, 1935, p. 415.

1926. *Cyclorhamphus eleutherodactylus* Brazil and Vellard, p. 43.—A. Lutz, 1928, p. 640; 1929a, p. 10.—Myers, 1946, pp. 11, 29.

1929. *Cyclorhamphus eleutherodactylus strigillata* A. Lutz, 1929a, pp. 13, 24, pl. 3, fig. 5 (type locality, Alto da Serra, São Paulo).

?1929. *Cyclorhamphus eleutherodactylus variegata* A. Lutz, 1929a, pp. 12, 13, 24, pl. 1, figs. 5, 6 (type localities, Tijuca, Rio de Janeiro, and Serra da Bocaina on the Rio de Janeiro–São Paulo boundary).

1951. *Cycloramphus eleutherodactylus* Bokermann, pl. 87, figs. 6, 6,a, 14, 16, 26, 29.

Description.—Adult male, USNM 98084, Ouro Prêto, Minas Gerais. Vomerine teeth in two small, well-separated groups near the inner posterior borders of the choanae; tongue more than two-thirds the width of mouth-opening, rounded in front, truncate on its free posterior margin, raised on a not very apparent stalk; a single, low, toothlike prominence on anterior border of lower jaw; snout rounded but not blunt when seen from above, sloping forwards to upper lip, which is thickened but has no prominent rim, the upper jaw scarcely projecting beyond lower; nostrils small, superior, separated from each other by an interval equal to their distance from eye. Canthus rostralis not evident; loreal region slightly concave and sloping outwards almost horizontally. Eye large, prominent, its diameter slightly greater than its distance from nostril, about three-fourths its distance from end of snout; interorbital diameter a little greater than upper eyelid, considerably greater than distance between nostrils. Tympanum not visible. Fingers fairly long, free, without any trace of lateral fringes, without disks, second slightly shorter than fourth and reaching to base of antepenultimate phalanx of third; no pronounced pollex, but the palmar tubercles very well developed, as well as the subarticular tubercles; toes free, without fringes, third longer than fifth, reaching slightly beyond base of antepenultimate phalanx of third, which is quite long; subarticular tubercles distinct; a prominent oval inner and a small round outer metatarsal tubercle; a very faint inner tarsal ridge; body broadly elliptical in shape, in postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches slightly beyond anterior border of eye; when limbs are laid along the sides, knee and elbow considerably overlap; when hind legs are bent at right angles to body, heels touch. Skin of dorsum nearly smooth, with a few scattered low glandules across the occiput and above the shoulder; a weak glandular line above the tympanic region, and a much heavier diagonal glandular fold ending above the upper arm insertion; an extremely prominent, smooth, large, concave, kidney-shaped inguinal gland, its edges standing out in a ridge above the surrounding skin; ventral surfaces smooth except for some indistinct granules on the femur below the anus. No skinfold across the chest. No apparent external vocal sac or thumb spines.

Dimensions.—Head and body 43 mm.; head length 15 mm., width 19 mm.; femur 19 mm.; tibia 22 mm.; foot 21 mm.; hand 12 mm.

Color in alcohol.—Dorsum deep seal brown, immaculate except for some small round white spots on the side in front of inguinal disk and a few others above and in front of shoulder, on edge of upper lip, and at corner of mouth; an irregular row of slightly larger white spots along the posterior femur, and a few white patches on the anterior femur; hands and feet with a few light spots; ventral surface drab, with a few paler dots along the sides, on the arms and chest, and below the tibia; inguinal gland pale drab, spotted with white.

Variations—An example from Tijuca, USNM 96262, differs from the Ouro Prêto specimens in having a slightly longer snout and shorter legs, with distinct light crossbars across the upper surface of the femur This represents the form which A. Lutz designated as *variegata.* The comparison of a large series from Rio de Janeiro with topotypic examples from Alto da Serra, São Paulo, is needed to settle the status of this form. Two adult females from Ouro Prêto lack all traces of the inguinal gland. The smaller of these has a slight indication of a light-edged interorbital line, and the spots on the upper lip suggest the diagonal light bars found in the young specimens. These latter are fully formed at 11 mm. The two females have the adpressed heel reaching to the nostril. Fingers and toes are uniformly long and delicate in all the specimens. The vomerine teeth are very unequally developed, for in the described specimen they are small and rather weak, while in one of the adult females they are extremely heavy and nearly continuous in the center.

Remarks.—At Ouro Prêto all the specimens were found under mats of vegetation overhanging a rocky ledge wetted by seepage from springs. The frogs were secured by pulling down and shaking the masses of moss until they jumped out. They were not particularly agile in trying to make their escape over the bare rocks.

It is interesting to note the similarity of this species to *Craspedoglossa stejnegeri* (Noble) in its structural features. The most appreciable differences are the slightly rougher skin of *C. stejnegeri* and its shorter legs, together with its lack of an inguinal gland.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, Tijuca, USNM 96262, A. Lutz, Aug. 13, 1929.

Minas Gerais: Ouro Prêto, USNM 96999, 97000, A. Lutz, Dec. 13, 1933; USNM 98058, 98078–82, 98084–5, Cochran, Dias, and Venancio, Mar. 18–19, 1935.

Rio de Janeiro: Petrópolis, BM 1923.10.2.62–63, Michaelis.

São Paulo: Juquiá, 8 km. north of, MZUM 104267 (2), Bailey, 1941.

Cycloramphus fulginosus Tschudi

Plates 23, Figures c, d, 34, Figure d

1838. *Cycloramphus fulginosus* Tschudi, p. 81 (type locality, "India").

1841. *Cycloramphus fuliginosus* Duméril and Bibron, p. 454, pl. 87, fig. 3.—Barbour and Noble, 1920, p. 407.—Miranda-Ribeiro, 1926, pp. 44, 201.—Bokermann, 1951 (part), pp. 81, 85, figs. 5, 5,a, 11, 20, 23, 30.

1858. *Pithecopsis fuliginosus* Günther, p. 22.—Cope, 1867, p. 206.

1864. *Telmatobius brasiliensis* Steindachner, 1864a, p. 282, pl. 16, figs. 3–3,c (type locality, vicinity of Rio de Janeiro).—Miranda-Ribeiro, 1920b, p. 261.

1882. *Cyclorhamphus fuliginosus* Boulenger, 1882a, p. 169.—Baumann, 1912, pp. 149, 161.—Miranda-Ribeiro, 1920, p. 276; 1926, p. 40.—Nieden, 1923, p. 368.—A. Lutz, 1928, p. 640; 1929a, p. 10.—Barbour and Loveridge, 1929, p. 248.—Myers, 1946, pp. 11, 28.—B. Lutz, 1947, p. 246.

1912. *Telmantobius brasiliensis* Baumann, pp. 150, 161.

1920. *Cycloramphus brasiliensis* Barbour and Noble, p. 407.—Miranda-Ribeiro, 1920b, p. 276.

1920. *Telmatobius fuliginosus* Barbour and Noble, p. 407.

1926. *Iliodiscus brasiliensis* Miranda-Ribeiro, p. 46, fig. 25; 1929b, pp. 13, 28.

1935. *Grypiscus brasiliensis* Miranda-Ribeiro, p. 416, pl. 3, fig. 3 (after Steindachner).

1935. *Grypiscus fuliginosus* Miranda-Ribeiro, p. 415.

Description.—Adult female, USNM 96264, Tijuca, city of Rio de Janeiro. Vomerine teeth in two very heavy, nearly contiguous, slanting patches behind the posterior borders of the choanae; tongue two-thirds the width of mouth-opening, rounded, its posterior border free; a toothlike process, apparently single, on anterior border of lower jaw; snout rounded when seen from above, slanting steeply forwards in profile, the upper lip thickened; upper jaw not projecting beyond lower; nostrils superolateral, distinctly projecting, separated from each other by an interval slightly greater than their distance from eye. Canthus rostralis rounded but evident because of the very concave loreal region below it. Eye large, prominent, its diameter about 1⅓ times its distance from nostril, slightly less than its distance from end of snout; interorbital diameter about equal to width of upper eyelid, equal to interval between nostrils. Tympanum not visible. Fingers moderate in length, free, their tips rounded but not enlarged, second longer than first, shorter than fourth, reaching to base of penultimate phalanx of third; no pronounced pollex, but both palmar tubercles well developed; subarticular tubercles moderate; toes almost fully webbed except for two terminal phalanges of fourth, their tips enlarged into small disks, third as long as fifth, reaching halfway to base of penultimate of fourth which is rather long; subarticular tubercles prominent; an elongate blunt inner and a small round outer metatarsal tubercle; a slight glandular tarsal ridge fading out midway to heel; body oval in shape, in postaxillary region narrower than greatest width of head; when hind leg is adpressed, heel reaches slightly beyond tip of snout; when hind limbs are laid along the sides, knee reaches to axilla; when hind legs are bent at right angles to body, heels touch. Skin of upper parts slightly granular, more definitely so on top of head; a weak glandular ridge from posterior corner of eye to shoulder; no inguinal gland apparent in this female specimen; ventral surfaces smooth, or minutely pustular under the lens, with a few larger pustules across the throat; some small granules behind the axilla and a few on the posterior femur. No apparent skinfold across the chest. (Probably no external vocal sac in the male.)

Dimensions.—Head and body 33 mm.; head length 11 mm., width 14.5 mm.; femur 18 mm.; tibia 18.5 mm.; foot 16 mm.; hand 10 mm.

Color in alcohol.—Dorsal surfaces ecru-drab suffused with seal brown down center of back; snout walnut brown, with a clove-brown interorbital band preceded by a wide pale band; upper lip drab, with three of four rhomboidal dark spots; traces of dark crossbands on forearm and tibia; ventral surface buff, with slightly darker marblings on throat; upper and lower surfaces of toes and fingers with a dark spot on the base of each disk; posterior femur clouded with dark suffusions.

Variations.—The three additional examples with the same data are smaller but do not differ otherwise. The leg is long in all of them, while the web of the foot is uniformly full, that from the third and fifth toes coming entirely up to the base of the respective disks. No trace of an inguinal gland is found in any of these specimens, but this may be due to the fact that two are immature while the others are perhaps females.

Remarks.—One of these specimens, USNM 96265, as well as a specimen of *C. umbrinus*, USNM 97417, were sent to Dr. Otto Wettstein, Naturhistorisches Museum, Vienna, for comparison with Steindachner's type of *Telmatobius brasiliensis*. Under date of February 26, 1938, he writes: "Mit dem Typus von *Telmatobius brasiliensis* Steind. stimmt Ihr Exampl. No. 96265 genau in jeder Hinsicht, selbst in der grosche, uberein, und ist sicher diese Art. No. 97417 hat mit *T. brasiliensis* nichts zutren und muss eine andere Art sein."

Specimens examined

BRAZIL: MHNP 750 (2), Delalande.

Districto Federal: NHMW (1; type of *Telmatobius brasiliensis*), Natterer, October 1836. Rio de Janiero, Tijuca, USNM 96264–7, A. Lutz, December 1931.

Rio de Janeiro: Mountains near Rio de Janeiro, ZSBS 53/1947, A. Lutz.

Cycloramphus granulosus A. Lutz

Plate 23, Figures e, f

1929. *Cyclorhamphus granulosus* A. Lutz, 1929a, pp. 13, 25, pl. 3, figs. 3, 4 (type locality, [Bonito], Serra da Bocaina, boundary of Rio de Janeiro and São Paulo).

1929. *Iliodiscus granulosus* Miranda-Ribeiro, 1929b, p. 17.

1935. *Craspedoglossus bolitoglossus* (not of Werner) Miranda-Ribeiro, p. 416.

?1935. *Grypiscus scleromeris* Miranda-Ribeiro, p. 415 (new name for *Grypiscus umbrinus* A. Lutz).

1951. *Cycloramphus granulosus* Bokermann, p. 86, figs. 2, 2,a, 22.

Description.—Adult male, USNM 96742 (cotype of *Cycloramphus granulosus*), Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two short, transverse, nearly contiguous patches behind and between the choanae; tongue half as wide as mouth opening, rounded posteriorly; a single toothlike process on anterior border of lower jaw; snout very bluntly rounded when seen from above, sloping forwards to the upper lip which has a slightly thickened rim, the upper jaw not projecting beyond lower; nostrils very small, superior, on a single low nasal elevation, separated from each other by an interval a little greater than their distance from eye. Canthus rostralis not evident; loreal region slightly concave and sloping outwards towards the flaring upper lip. Eye large, prominent, its diameter twice its distance from nostril, equal to its distance from end of snout; interorbital diameter slightly greater than width of upper eyelid and greater than distance between nostrils. Tympanum not visible. Fingers short, free, with slight traces of lateral fringes, their tips ending in round disks which are not wider than the preceding phalanx; second longer than first, shorter than fourth and reaching nearly to base of penultimate phalanx of third; no pronounced pollex, but both palmar tubercles well developed; subarticular tubercles moderate; toes webbed only at the base, slightly fringed, their tips also in ball-like disks, third toe longer than fifth, reaching halfway to base of penultimate phalanx of fourth which is moderately long; subarticular tubercles small but distinct; an oval inner and a small round outer metatarsal tubercle; a very slight tarsal ridge; body broadly elliptical in shape, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches center of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels are separated. Skin of top of head and back heavily tubercular, less granular on upper limb surfaces; a diagonal dermal ridge from posterior corner of eye to angle of mouth; a small round inguinal gland; ventral surface minutely granular, the granules more prominent on posterior surface of femur. No skinfold across the chest. No external vocal sac.

Dimensions.—Head and body 42.5 mm.; head length 17 mm., width 18.5 mm.; femur 19 mm.; tibia 18.5 mm.; foot 20 mm.; hand 10.5 mm.

Color in alcohol.—The cotype has faded to a uniform buff without traces of any pattern. Some topotypes, taken in March 1934, still retain their color pattern. One of these, USNM 96743, is uniform seal brown above, with a few of the tubercles tipped with pale gray, these seeming to occur in short diagonal lines along the dorsolateral region. The limbs are also seal brown, the femur nearly immaculate except for a few small scattered gray dots on its upper surface, the tibia with gray spots arranged in crossbars. The ventral region is a pale sepia with white dots on the chest and a darker reticulation on the throat. The last phalanx of each toe and finger is almost white, with a small black spot on top of each ball-shaped disk.

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96742 (cotype of *Cycloramphus granulosus*), A. Lutz, February 1928; USNM 96743–51, A. Lutz, March 1934. Mountains near Rio de Janeiro, ZSBS (1), A. Lutz, 1923. Serra da Bocaina, ZSBS (1), A. Lutz, 1932.

Cycloramphus neglectus A. Lutz

Plate 23, Figures g, h

1907. *Telmatobius asper* Boulenger, p. 394 (type locality, Teresópolis, Santa Catarina).—Baumann, 1912, p. 161.—Miranda-Ribeiro, 1920b, p. 264.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 376.

1928. *C[ycloramphus] neglectus* A. Lutz, p. 640 (new name for *Telmatobius asper* Boulenger).

1929. *Cyclorhamphus boulengeri* A. Lutz. 1929a, pp. 11, 23 (new name for *Telmatobius asper* Boulenger).
1951. *Cycloramphus asper* (not of Werner) Bokermann (part), p. 82.

Description.—Adult male, USNM 97179 (cotype of *Cycloramphus boulengeri*), São Bento, Santa Catarina. Vomerine teeth in two short, transverse, nearly contiguous patches behind and between the choanae; tongue half as wide as mouth-opening, oval, its posterior part slightly raised on a thickened stalk; a single toothlike process on the anterior border of the lower jaw; snout broadly rounded when seen from above, slanting forward and ending in a sharp ridge bordering the upper lip when seen in profile, the upper jaw not projecting beyond lower; nostrils very small, superolateral, placed on a distinct elevation, separated from each other by an interval greater than their distance from eye. Canthus rostralis very blunt; loreal region flat, sloping outward towards the ridge bordering upper lip. Eye large, prominent, its diameter twice its distance from nostril; interorbital diameter equal to width of upper eyelid and to distance between nostrils. Tympanum not visible. Fingers free, slightly fringed, their tips not dilated, second finger longer than first, shorter than fourth, and reaching nearly to base of penultimate phalanx of third; no pronounced pollex; subarticular and palmar tubercles greatly reduced; toes three-quarters webbed, their disks not dilated, third toe distinctly longer than fifth, reaching nearly to base of penultimate phalanx of fourth which is not very long; subarticular tubercles reduced to blunt knobs below joints of toes; an indistinct inner and no outer metatarsal tubercle; a distinct inner tarsal ridge from inner metatarsal tubercle to heel; body very wide anteriorly, tapering posteriorly, in postaxillary region slightly narrower than the very wide head; when hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow considerably overlap; when hind legs are bent at right angles to body, heels barely touch. Skin of upper parts covered with fine tubercles which are most prominent behind the eyes and across anterior half of back; upper parts of limbs smooth, with only a few scattered tubercles; a very prominent, thick, rounded inguinal gland, concealed when the legs are in the normal sitting position; a slight skinfold from posterior border of eye to corner of mouth; throat and chest slightly granular, abdomen and lower limb surfaces smooth; a small granular patch around anus. No apparent skinfold across the chest. No external vocal sac.

Dimensions.—Head and body 37 mm.; head length 13 mm., width 16 mm.; diameter of eye 5 mm.; femur 18 mm.; tibia 17 mm.; hind limb 53 mm.; fore limb 23 mm.; foot 17.5 mm.; hand 10.5 mm.

Color in alcohol.—Dorsum cinnamon brown with slightly darker suffusions behind the eyes and on anterior half of back; a sepia patch in the groin, and a wide irregular sepia stripe along posterior femur; upper surfaces of limbs with slight traces of dark crossbands; upper lip with faint triangular spots below eye; ventral surface cinnamon, with small white dots on the throat.

Variations.—Two cotypes, USNM 97180–1, from São Bento, are immature, measuring 26 and 23 mm., respectively. In a fine series of 19 individuals from Rio Humboldt, Santa Catarina, the largest, a female, MCZ 19501, measures 43 mm. The males are smaller, averaging about 37 mm. In them, the inguinal gland is thick and well marked; it is entirely lacking in the female. The web comes right up to the tip of the fifth toe on almost all specimens, although the three last phalanges of the fourth toe are free at least on its outer side. In MNHP 50-435 the heel reaches only the center of eye; in MNHP 50-436 it reaches to between eye and nostril.

Remarks.—*Cycloramphus neglectus* is very close to *C. asper* from Alto da Serra in general texture of skin and in bodily proportions as well as in color pattern. The most obvious difference is in the webbing, which in *neglectus* is fairly extensive, coming to the tip of the fifth toe, but which in *asper* is very scanty, appearing only as a vestige between the fourth and fifth toes. The described specimen, USNM 97179, was sent to H. W. Parker, British Museum (Natural History), who wrote on June 7, 1937: "This is rather a poor specimen, but as far as one can tell it agrees well with the types of *Cyclorhamphus boulengeri* (=*asper* of Boulenger)."

Specimens examined

BRAZIL:

Santa Catarina: ZMB 15510, Weichberger. Hansa, BM 1928.11.5.1–15 and NMZS (2), Erhardt. Humboldt, MCZ (20). Rio Humboldt, USNM 66577–9, Fritsche, November 1918; BM 1923.6.1.1–8, Fritsche. Rio Novo, ZSBS (5). São Bento, USNM 97179–81, A. Lutz, 1929. Teresópolis, ZMB 28028 and BM 1905.7.24.13–16 (cotypes of *Telmatobius asper*), Michaelis; ZSBS 227/12, 1920; MHNP 50–435–6, Michaelis.

São Paulo: Boracea, DZSP 2966 and USNM 129150, Vanzolini and Bokermann, Dec. 12–18, 1947. Juquiá, 8 km. north of, MZUM 104266 (4), Bailey, 1941.

Cycloramphus ohausi (Wandolleck)

Plate 23, Figures i, j

1907. *Ceratophrys ohausi* Wandolleck, p. 10 (type locality, Petrópolis, Rio de Janeiro), pl. 1, figs. 2, 2,a.—Baumann, 1912, p. 162.—Nieden, 1923, p. 385.

1926. *Fritzia ohausi* Miranda-Ribeiro, p. 107.

1932. *Cyclorhamphus distinctus* A. Lutz, 1932b, p. 71 (type locality, Petrópolis, Rio de Janeiro).

1951. *Cicloramphus distinctus* Bokermann, p. 89, figs. 4, 4,a, 10, 19, 22, 23.

Description.—Adult male, USNM 118998, Teresópolis, Rio de Janeiro. Vomerine teeth in two very heavy, transverse, nearly contiguous patches behind the choanae; tongue two-thirds the width of mouth-opening, round, without any indentation on its nearly attached posterior border; a single toothlike process on anterior border of lower jaw; snout very bluntly rounded when seen from above, sloping forwards to the upper lip which has a distinctly ridged and thickened border, the upper jaw not projecting beyond the lower; nostrils small, superior, on a pair of low nasal elevations, separated from each other by an interval equal to their distance from eye. Canthus rostralis not evident; loreal region concave, and sloping outwards to the flaring upper lip. Eye moderately large, prominent, its diameter a little greater than its distance from nostril, but less than its distance from end of snout; interorbital diameter equal to width of upper eyelid and to distance between nostrils. Tympanum not visible. Fingers moderate, free, with a slight trace of lateral ridges, the tips not dilated, fourth longer than second and reaching almost to base of penultimate phalanx of third; two large, distinct palmar tubercles; subarticular tubercles on hands and feet very distinct; toes webbed at the base, with pronounced lateral fringes, third longer than fifth, reaching to base of antepenultimate phalanx of fourth; an oval inner and a smaller, round, outer metatarsal tubercle; an inner tarsal ridge. Body broadly elliptical in shape, in postaxillary region about equal to greatest width of head; when hind leg is adpressed, heel reaches to commissure of jaw; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to the body, heels touch. Skin of upper parts covered with spinose warts that outline a dark triangular area behind the eyes on the occiput; crescentic rows of warts along temporal area, and others on the sacrum; a line of warts across the upper eyelids and on the interorbital area; dark crossbars on legs outlined with warts; venter entirely smooth except for a few granules below the vent. Evidence of a weak external vocal sac; a patch of 13 (on the right) and 3 (on the left) black spines of varying sizes on the base of the thumb.

Dimensions.—Head and body length 38.5 mm.; head length 14.5 mm., width 17 mm.; femur 17 mm.; tibia 17 mm.; foot 18 mm.; hand 11 mm.

Color in alcohol.—Dorsum dark sepia anteriorly, lightening to russet posteriorly; a darker brown triangular patch between the eyes, extending onto the occiput; a few indistinct, dark, elongate, dorsal markings; legs with two brown crossbars; venter pale wood brown, the throat and belly with faint, slightly darker marblings.

Variations.—The only other example of this species in the U. S. National Museum is a younger male, from the same locality, having two black spines on each thumb. Its pattern is a little brighter than that of the described specimen, and the dark sinuous dorsal marks, outlined by the regular rows of pale warts, like small nailheads, make a very distinctive pattern.

Remarks.—The type of *C. ohausi* was a young specimen only 18 mm. long. Dr. Wandolleck wrote to me on Nov. 27, 1937, that no breeding spines on the thumb were apparent. As the Zwinger Museum was being rebuilt in 1938 when I visited Dresden, the type unfortunately was not available to me for examination, but the excellent colored figures given by Dr. Wandolleck leave no room for doubt that this species is the same as *Cycloramphus distinctus* Lutz, described 25 years later. It is localized in the mountains of Rio de Janeiro, where it was found at Petrópolis by Dr. A. Lutz in 1930 and 1931, and at Teresópolis by Dr. B. Lutz in 1939.

In appearance it suggests a hornless *Ceratophrys*, which Wandolleck believed it to be, and it appears to be one of the transition forms that establish a degree of relationship between *Ceratophrys* and *Cycloramphus*.

Specimens examined

BRAZIL:

RIO DE JANEIRO: Teresópolis, USNM 118998–9, Venancio, April 1939.

Cycloramphus umbrinus (Cope)

PLATE 23, FIGURES K, L

1867. *Grypiscus umbrinus* COPE, p. 206 (type locality, Rio de Janeiro).—NIEDEN, 1923, p. 354.—BARBOUR, 1925, p. 8.—MIRANDA-RIBEIRO, 1926, p. 39, fig. 22; 1935, p. 413.—BARBOUR and LOVERIDGE, 1929, p. 270.
1928. *Cyclorhamphus fuliginosus* (not of Tschudi) A. LUTZ, p. 640; 1929a, pp. 10, 22, pl. 1, figs. 1, 2; pl. 2, figs. 1, 5; pl. 5, figs. 4–6.
1929. *Iliodiscus lutzi* MIRANDA-RIBEIRO, 1929b, pp. 15, 30 (new name for *Cycloramphus fuliginosus* (not of Tschudi) Lutz).
1935. *Grypiscus lutzi* MIRANDA-RIBEIRO, p. 415.
1951. *Cycloramphus fuliginosus* (not of Tschudi) BOKERMANN (part), p. 81.

Description.—Adult male, USNM 81144, city of Rio de Janeiro. Vomerine teeth in two, heavy, slanting, well separated patches behind the posterior borders of the choanae; tongue two-thirds as wide as mouth opening, rounded, its posterior border quite free, raised on a thickened stalk; a trilobed toothlike process on anterior border of lower jaw, the central lobe most prominent; snout rounded when seen from above, slanting forwards but truncate at the very tip in profile due to the thickened rim of upper lip; upper jaw not projecting beyond lower; nostrils small, superior, slightly projecting, separated from each other by an interval a little less than their distance from eye. Canthus rostralis curved and evident, due to the very concave, nearly horizontal region below it. Eye large, prominent, its diameter 1⅔ its distance from nostril, a little less than its distance from end of snout; interorbital diameter 1⅓ times the width of upper eyelid, a little greater than interval between nostrils. Tympanum not visible. Fingers moderate in length, free at the base but with dermal ridges on the sides, their tips ending in ball-like disks which are very slightly wider than the adjoining phalanx; second finger longer than first, shorter than fourth, reaching to base of penultimate phalanx of third; no pronounced pollex, but both palmar tubercles well developed; subarticular tubercles moderate; toes three-fourths webbed, their tips enlarged into small disks, third longer than fifth, reaching to base of penultimate phalanx of fourth, which is fairly long; subarticular tubercles rather prominent; a large blunt oval inner and a triangular outer metatarsal tubercle; a distinct glandular tarsal ridge; body broadly elliptical in shape, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches to anterior border of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels fail to meet. Skin of upper part of head and back roughened with fine granules; some irregular larger granules along the dorsolateral region from eye almost to groin; a curving dermal ridge from posterior corner of eye to front of shoulder; a large, flat, semicircular inguinal gland; throat, chest, and lower surface of arms coarsely granular, belly and postanal region minutely granular; lower surface of legs quite smooth. Traces of a slight skinfold across the chest. No external vocal sac.

Dimensions.—Head and body 51 mm.; head length 19 mm., width 22 mm.; femur 23 mm.; tibia 23 mm.; foot 22 mm.; hand 13 mm.

Color in alcohol.—Dorsum burnt umber, lightening to cinnamon posteriorly, a wide transverse lighter band between the eyes; traces of darker crossbands on upper surface of forearm and tibia, and of small light dots on posterior femur; venter cinnamon, darker on the throat and chest, where many small light spots occur; tips of toes apparently light, with a central dark spot on the upper side of the terminal phalanx.

Color in life.—Based on my color notes of two adults from Tijuca. The larger, USNM 97417: Dorsum very dull clove brown mixed with russet and sepia on the limbs; a wood-brown crossband between the eyes; venter close to chocolate brown, spotted with white; inguinal glands the same color; iris mostly Indian purple with very small coppery flecks and dark lines. The smaller, USNM 97418: Similar but less russet on back and more russet between crossbars on hind legs; chin clove brown, throat seal brown lightening to olive gray on belly; lower surface of limbs dark drab-gray. A young specimen taken at the same time was olive-gray to olive-buff above, tinged with buff behind axilla, with small irregular slate-colored spots. The lower surface was immaculate pale olive-buff.

Variations.—Two examples from Petrópolis do not differ from the Tijuca specimens. They have the same interocular light spot, the same degree of webbing on the toes and a similar slightly granular to smooth dorsal skin.

While the described specimen has a distinctly granular dorsal skin, these Tijuca specimens show a variation from moderately granular to perfectly smooth. It appears therefore that the character of smooth or granular skin is of little value when applied to this particular form.

The adpressed heel of USNM 81144 and of one other individual reaches only to center of eye; on the remaining specimens the heel reaches to the anterior border of the eye. The web is slightly variable in extent, being sometimes distinctly incised from the outer toe to where it joins the fourth toe, at other times nearly straight across.

The series of adult and semiadult specimens at hand is not sufficient to give a complete picture of the actual limits of variation.

Remarks.—This species is easily confused with *fulginosus* but it may be separated on the basis of its much shorter hand, foot, femur, and tibia, and the adpressed heel not reaching beyond the eye, whereas in the other species the heel extends beyond the tip of the snout. The webbing of its foot is also less extensive.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, USNM 81144, A. Lutz, June 1930; USNM 96376 (eggs), A. Lutz, October 1929. Manguinhos, IB 118; USNM 121319. Pico de Tijuca, MZUM 104245 (4), Bailey, 1941; USNM 96263, A. Lutz, Aug. 24, 1930; USNM 97417–9, A. Lutz, Cochran, and Venancio, Jan. 21, 1935; MCZ 15826; MZUM 68770, A. Lutz.

Rio de Janeiro: Barro Branco, MZUM 104246 (7), Bailey, 1941. Independencia near Petrópolis, USNM 96429 (eggs), A. Lutz, Jan. 5, 1928; USNM 96428, A. Lutz, December 1927. Mountains near Rio de Janeiro, ZSBS 96376 (1), A. Lutz, 1931. Serra de Petrópolis, USNM 96418, A. Lutz, November 1928; MCZ 15827.

Genus *Eleutherodactylus* Duméril and Bibron

1841. *Eleutherodactylus* Duméril and Bibron, p. 620. (Genotype, *Hylodes martinicensis* Tschudi.)

Generic diagnosis.—Pupil horizontal. Tongue subcircular or oval, entire or slightly nicked and free behind. Vomerine teeth. Tympanum generally distinct. Fingers free; toes free or slightly webbed, with dilated tips. Outer metatarsals united. Omosternum cartilaginous; sternum a cartilaginous plate. Terminal phalanges T-shaped.

The genus *Eleutherodactylus* in southeastern Brazil is not very rich in number of species, nevertheless their identification is rendered somewhat difficult by the great variation found among some of them. Examples of *E. guentheri* from Rio de Janeiro, for instance, have been figured with no less than five different color patterns by Steindachner. The variations in pattern in some members of this genus have recently been worked out by Goin (1950).

Only some very young frogs identified as *Hylaplesia nigriventris* A. Lutz (1925a, p. 139; type localities, Itatiaia [Rio de Janeiro] and Serra de Cubatão [São Paulo]) were found in the Instituto Oswaldo Cruz at the time of my visit there in 1935. These small frogs were similar to young of *Eleutherodactylus guentheri*. Until freshly collected adult topotypes can be identified and studied, no satisfactory conclusion can be drawn as to the identity of *nigriventris*.

For a statistical analysis of measurements of the species *Eleutherodactylus* here discussed, see pages 373 and 382.

Key to Eleutherodactylus of southeastern Brazil

a^1. First finger longer than second . . . . **binotatus** (p. 269)
a^2. First finger shorter than second.
  b^1. Heel reaching beyond snout.
    c^1. Upper lip flaring considerably, so that snout appears nearly oval. **guentheri** (p. 271)
    c^2. Upper lip flaring slightly, so that snout has nearly straight sides and rounded tip . . . . **nasutus** (p. 274)
  b^2. Heel not reaching beyond anterior corner of eye.
    c^1. Interorbital diameter twice the width of upper eyelid . **parvus** (p. 276)
    c^2. Interorbital diameter barely as great as upper eyelid . **unistrigatus holti** (p. 279)

Eleutherodactylus binotatus (Spix)

Plate 24, Figures a, b

1824. *Rana binotata* Spix, p. 31, pl. 20, fig. 3 (type locality not given).
1871. *Hylodes rugulosus* (not of Cope) Peters, 1871b, p. 648.
1873. *Hylodes binotatus* Peters, 1873a, pp. 206, 219.—Boulenger, 1882a, p. 209.—Baumann, 1912, p. 161.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 460.—Miranda-Ribeiro, 1923c, p. 836, pl. [1], figs. f, g; 1926, p. 56, figs. 33, 34.—deWitte, 1930a, p. 223.—Mello-Leitão, 1937, p. 267.
1927. *Eleutherodactylus binotatus* L. Müller, p. 273.—Mertens, 1930, p. 162.—Travassos, 1944, p. 127.—Myers, 1946, pp. 10, 18.
1929. *Hylodes cinotatus* [sic] Luederwaldt, p. 39.

Description.—Adult male, USNM 97403, Tijuca, city of Rio de Janeiro. Vomerine teeth in large, slanting, well-separated arcs behind the choanae; tongue slightly more than one-half the width of mouth-opening, rounded, with a notch in its free posterior border; snout long, bluntly pointed when seen from above and in profile, the upper jaw projecting considerably beyond lower; nostrils lateral, their distance from end of snout one-half their distance from eye, separated from each other by an interval equal to three-fourths their distance from eye. Canthus rostralis sharp; loreal region flat, the upper lip flaring outwards below it. Eye large, very prominent, its diameter four-fifths the length of snout; interorbital diameter slightly greater than width of upper eyelid, 1⅓ times the distance between nostrils. Tympanum distinct, one-half the diameter of eye, separated from eye by two-thirds its own diameter. Fingers rather short, free, second shorter than fourth, first longer than second and fourth, all with rounded tips, which are only slightly dilated; a heavy pointed elongate pad at base of first finger and a flattened oval one on palm; all metacarpal tubercles very greatly developed; toes moderately long, free, with slightly dilated tips, third slightly longer than fifth and reaching to base of antepenultimate phalanx of fourth; a small conical inner metatarsal tubercle and a rounded, flat outer one; metatarsal tubercles very well developed, those below the proximal joints being larger than the inner metatarsal tubercle; no tarsal ridges, instead a row of weak round or elongate glandules on outside of tarsus. Body rather stout, in postaxillary region equal to greatest head width. When hind leg is adpressed, heel reaches a little beyond tip of snout; when limbs are laid along the side, knee and elbow greatly overlap; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts minutely glandular, with 8 to 10 fine, broken, sinuous granular ridges from posterior half of each eyelid to the sacral region; some small granules above coccyx, extending onto posterior femur; a narrow, distinct supratympanic ridge, with rounded heavy glandules at corner of mouth and smaller ones in front of tympanum. Venter smooth, with a prominent ventral disk. No apparent external vocal sac.

Dimensions.—Head and body 54 mm.; head length 21 mm., width 21 mm.; femur 26 mm.; tibia 30 mm.; foot 26 mm.; hand 14 mm.

Color in alcohol.—Dorsum pale olive-yellow; a dark brown stripe along canthal region; a pair of light brown spots where the glandules end at sacrum; three pale gray crossbars on femur and tibia, and one or two fainter ones on forearm; upper lip pale gray, with traces of light diagonal bars in front of and behind the eye; venter immaculate pale buff.

Color in life.—Upper surface clay color tinged with vinaceous-buff. A clove-brown stripe along the canthus, ending behind ear, and a clove-brown stripe along outer side of tibia. Pupil gold above, with a brown line through it; below more coppery and greenish, the entire area sprinkled with fine black dots.

Remarks.—This species appears to be less common than *E. guentheri* although it is by no means rare. The short second finger makes this species at once distinguishable from *Eleutherodactylus guentheri*, which inhabits nearly the same regions in southeastern Brazil. The peculiar sculptured pattern of the dorsal ridges is also an easy means of identifying this species, while other features that facilitate recognition are its large head and the small tubercular ridges on the heel, which sometimes almost amount to heel appendages.

The head is often very slightly longer than broad, but in several specimens the width and the length of the head are the same. The heel may reach only to between eye and nostril, or may extend beyond the tip of the snout, as it more frequently does. A pair of dark, small, widely separated sacral spots appear to be usually present, while another pair much closer together lie on the occipital region, and several small spots accentuate the interocular bar.

Specimens examined

BRAZIL: ZSBS 1050/0; ZSBS 2695/0 (type of *Rana binotata*), Spix.

Districto Federal: Rio de Janeiro, BM 45.5.25.6–7, Darwin; ZSBS (1), A. Lutz, 1932. Jardim Botánico, MRHN IG 9308 Reg. 50g and 50b, Massart, 1922. Covanca, Jacarépaguá, USNM 97470, Cochran, Dias, and Venancio, Feb. 7, 1935. Tijuca, USNM 97403, A. Lutz, Cochran, and Venancio, Jan. 21, 1935; USNM 96299, A. Lutz, Oct. 6, 1933; MZUM 104258–9, Bailey, 1941.

Espírito Santo: Santa Leopoldina, ZSBS 292/1920.

Minas Gerais: Montes Claros, IB 516. Viçosa, IB 552.

Pernambuco: Iguaraçu, BM 88.4.18.16, Ramage.

Rio de Janeiro: Angra dos Reis, USNM 70581, Metcalf, Oct. 15, 1925; USNM 96503–4, A. Lutz, Apr. 27, 1924. Barreira, Teresópolis, ZSBS 452, Bresslau, Feb. 16, 1914; ZSBS 550, Bresslau, Mar. 10, 1914. Barro Branco, MZUM 104261, Bailey, 1941. Colomi, Teresópolis, USNM 97723, Sandig, Apr. 10, 1935. Mountains near Rio de Janeiro, ZSBS 78/47 (8), A. Lutz. Nova Friburgo, USNM 97760, B. Lutz, Cochran, and Venencio, May 11, 1935.

Santa Catarina: ZSBS 15/1922, (2), Erhardt. Humboldt, ZSBS 28/1922, Erhardt, October 1917.

São Paulo: Alto da Serra, MRHN IG 9308 Reg. 50 and 50d, Massart, October 1922. Butantan, IB 66. Cantareira, IB 582–3. Cruzeiro, BM 1901.3.1.13, Robert. Piquete, BM 1900.7.29.18–19, Robert. São Paulo, DZSP 2266–8, 2274, Bokermann, Jan. 6, 1948.

***Eleutherodactylus guentheri* (Steindachner)**

Plate 24, Figures c–e

1864. *Hylodes guentheri* Steindachner, 1864a, p. 246, pl. 17, figs. 1, 1,a (type locality, Brazil); 1867, p. 53, pl. 4, figs. 1–7.

1882. *Hylodes gollmeri* (not of Peters) Boulenger, 1882a (part), p. 205; 1888c, p. 416.—Baumann, 1912, p. 92.—L. Müller, 1922, p. 171.—Nieden, 1923, p. 464 (part).—?Miranda-Ribeiro, 1929a, p. 67.—deWitte, 1930a, p. 222.

1907. *Elosia divisa* Wandolleck, p. 4, pl. 1, figs. 7–7,b (type locality, Petrópolis, Rio de Janeiro).—Baumann, 1912, p. 161.—Nieden, 1923, p. 405.

1923. *Hylodes ranoides* (not of Spix) Miranda-Ribeiro, 1923c, p. 832, pl. [2]; 1926, p. 53, fig. 31.—Mello-Leitão, 1937, p. 341.
1927. *Eleutherodactylus gollmeri* L. Müller, p. 273.—Myers, 1946, pp. 1, 28.
1930. *Hylodes griseus* (not of Hallowell) deWitte, 1930a, p. 223.
1930. *Eleutherodactylus griseus* Mertens, p. 161.
1946. *Eleutherodactylus guentheri* Lynn and Lutz, 1946a, pp. 1–46, 4 pls.—Myers, 1946, pp. 1, 28.—B. Lutz, 1947, p. 249.

Description.—Adult male, USNM 97404, Tijuca, city of Rio de Janeiro. Vomerine teeth in two large, slanting contiguous patches far behind and between the choanae; tongue about three-fifths the width of mouth-opening, chordate, with a distinct indentation on its free posterior border; snout fairly long, rounded when seen from above, slanting forwards to edge of upper lip in profile, the upper jaw scarcely projecting beyond the lower; nostrils lateral, their distance from end of snout about one-third their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis very sharp, loreal region flat and nearly vertical, the upper lip flaring outwards below it. Eye large, fairly prominent, its diameter 1¼ times in length of snout; interorbital diameter equal to width of upper eyelid, slightly less than distance between nostrils. Tympanum distinct, two-fifths the diameter of eye, separated from eye by one-half its own diameter. Fingers free, fairly long, fourth longer than second, first shorter than second, all with well dilated tips; a pronounced rounded tubercle at base of first finger, and a smaller one on palm; metacarpal tubercles well developed; toes long, slightly webbed at base, with enlarged disks, fifth slightly longer than third, which extends to base of antepenultimate phalanx of fourth; a prominent, semicircular, inner metatarsal tubercle; no outer tubercle; no tarsal ridges. Body fairly slender, in postaxillary region a little less than greatest head width. When hind leg is adpressed, heel reaches well beyond tip of snout; when limbs are laid along the sides, knee and elbow strongly overlap; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts minutely glandular, with a glandular middorsal line and fainter lateral lines; a pair of curved ridges between the eyes ending in enlarged flattened protuberances behind the eyes; a W-shaped glandular ridge just behind the head; a few small scattered tubercles at corner of mouth below ear; a slight supratympanic ridge; venter smooth, with traces of a ventral disk; posterior femur slightly granular; apparently no external vocal sacs.

Dimensions.—Head and body 36 mm.; head length 14mm., width 13.5 mm.; femur 20 mm.; tibia 22 mm.; foot 20 mm.; hand 10 mm.

Color in alcohol.—Dorsum chestnut brown, with dark brown stripes bordering the lateral glands and those on shoulders and behind head; sides and legs pale ochre, with four narrow brown crossbars on posterior surface of femur and a few indistinct blotches on tibia and forearm;

upper lip dark, with a light bar in front of eye; venter pale, with some dark marblings around edge of lower jaw.

Color in life.—Based on live specimens taken at Tijuca on January 21, 1935. A large adult: Dorsum deep hair brown lightening to wood brown on the sides; lateral glandular line russet; black patches above ear and on groin; a buff-yellow vertical stripe in front of eye; limbs above pale wood brown banded with drab; throat pale olive-gray, chest and hind legs with pale malachite-green tinges below; belly maize yellow; iris iridescent malachite green on upper half, duller below, with gold and black lines near the iris, which is horizontally elliptic. A half-grown frog: Dorsum like the first but with less hair brown; venter the same; iris somewhat less green, more purplish before and behind. Nine young specimens had the body clay-color, buff, or orange-ochraceous above, with a very prominent postaxillary diagonal clove brown stripe, and another smaller dark stripe on postsacral region before the anus; markings on back mostly raw umber to sepia; sides below olive-buff to deep chrome.

The species is common in wooded mountains. Its call is a sort of quacking, suggesting that of a duck.

Remarks.—Although Boulenger considered *Hylodes guentheri* synonymous with *Hylodes gollmeri* Peters from Caracas, Venezuela, described the year before, the two species seem to differ in at least one important structural character; *gollmeri* has the interorbital space wider than the upper eyelid, while in *guentheri* from Rio de Janeiro it is equal or narrower. Until the types of *gollmeri* can be compared directly with specimens from Rio de Janeiro, it seems better to keep the two apart.

Nevertheless, the Brazilian form varies to a considerable extent, as Steindachner himself has shown in his figures of the various color patterns. Some specimens have a nearly immaculate brown back; others have a W-shaped dark mark on a light ground, as in Steindachner's figure of the type; and there are all grades of intervening patterns. The skin may be quite smooth, tubercular, or beset with short glandular ridges, which, however, do not form the parallel arrangement characterizing *binotatus*.

Specimens from Nova Friburgo seem to have merited specific designation because of the shape of the snout. While not all the measurements of specimens from Nova Friburgo on which Dr. A. Lutz based the name *Hylodes nasutus* indicate their separation from typical *guentheri* of Rio de Janeiro, yet the shape of the snout, viewed from above, is decidedly more pinched and attenuate, and the upper lip flares out more broadly in the latter. making its contour somewhat different.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, USNM 70587, Metcalf, Oct. 11, 1925; AMNH 530, 630; ZSBS 55/47, 74/47 (6), A. Lutz. Avenida Niemeyer, USNM 96383–5, A. Lutz, Jan. 3, 1923. Bambús, Tijuca, ZSBS (1), A. Lutz, Feb. 2, 1920. Sumaré, USNM 101131, Venancio, Jan. 1, 1929. Tijuca, USNM 96276–92, A. Lutz, December 1927; USNM 96293, A. Lutz, Apr. 20, 1922; USNM 96294–6, A. Lutz, Mar. 5, 1934; USNM 97404–14, A. Lutz, Cochran, and Venancio, Jan. 21, 1935; AMNH 17413, A. Lutz, April 1922; MZUM 104238 (4), 104239, 104260 (2), 104277 (4), 104279 (4), Bailey, 1941.

Minas Gerais: Gordura, ZSBS 67/14, Bresslau, Oct. 4, 1913. Rio Pandeiro, USNM 121302.

Rio de Janeiro: MRHN IG 9308 Reg. 37, IG 9404 Reg. 73b, Massart, September 1922. Angra dos Reis, USNM 70583–6, Metcalf, Oct. 15, 1925; USNM 96505–18, A. Lutz, Apr. 27, 1924. Barreira, near Teresópolis, ZSBS 610, 61/47 (2), Bresslau, Mar. 17, 1914. Bonito, Serra da Bocaina, USNM 96724–7, 96752, A. Lutz, 1930–31. Canella Preta, Serra da Estrella, USNM 97232–3, Venancio, Mar. 28, 1929. Colomi, near Teresópolis, USNM 97724–5, Sandig, Apr. 10, 1935. Guapi, near Teresópolis, USNM 97680, Sandig, 1935. Independencia, Petrópolis, USNM 97646–7, B. Lutz, Cochran, and Venancio, May 5, 1935. Serra da Bocaina, USNM 102310–1, Museu Paulista. Teresópolis, USNM 96452–4, A. Lutz, Feb. 9, 1929. Petrópolis, KZAEM D2041 (type of *Elosia divisa*), Ohaus.

Santa Catarina: São Bento, USNM 97173, Nahderer, 1923.

São Paulo: Alto da Serra, USNM 96805, A. Lutz, Feb. 12, 1923; USNM 97819–24, 97856–8, Cochran and Venancio, Apr. 25–26, 1935; MRHN IG 9404 Reg. 72 and 73, IG 9308 Reg. 73 and 50d, (7), Massart, 1922; USNM 123899, Sawaya. Cantareira, IB 574–5. Piedade, IB 577. São Paulo, USNM 129160–2, Bokermann, Jan. 4, 1948.

***Eleutherodactylus nasutus* (A. Lutz)**

Plate 24, Figures f, g

1925. *Hylodes nasutus* A. Lutz, 1925b, p. 213 (type locality, Nova Friburgo, Rio de Janeiro); 1926a, pp. 9, 15; 1930, p. 26.

1946. *Eleutherodactylus nasutus* Lynn and Lutz, 1946b, pp. 1–13, pl. a–b, figs. 1–3.—B. Lutz, 1947, p. 249; 1949a, p. 5.—Goin, 1950, pp. 12, 14.

Description.—Young female, USNM 96469 (cotype of *Hylodes nasutus*), Novo Friburgo, Rio de Janeiro. Vomerine teeth in two small, triangular, narrowly separated patches some distance behind the choanae; tongue almost two-thirds the width of mouth-opening, oval, with a very slight indentation on its free posterior border; snout quite long, rounded at the tip when seen from above and in profile; the upper jaw projecting considerably beyond the lower; nostrils superolateral, their distance from end of snout two-thirds their distance from eye, separated from each other by an interval equal to their distance from the eye. Canthus rostralis rounded but distinct; loreal region slightly concave and slanting only a little, the upper lip border flaring out beneath it. Eye large and prominent, its diameter contained 1½ times in the long snout; interorbital diameter slightly less than the wide upper eyelid, very slightly less than interval between nostrils. Tympanum moderate, distinct, two-thirds the width of eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, moderately long, second longer than first and shorter than fourth, not fringed, the disks distinctly bilobed above, that of third finger covering a little less than one-fourth the tympanic area; no pronounced pollex, but subarticular and palmar tubercles strongly developed; toes not fringed but with slight lateral ridges, their disks bilobed above, a little larger than those of fingers, that of fourth toe covering about one-third the tympanic area, third and fifth toes subequal and reaching only to base of antepenultimate phalanx of the very long fourth toe; a small oval inner and a round outer metatarsal tubercle; no tarsal ridge evident. Body moderate in build, in postaxillary region equal to greatest width of head; when leg is adpressed, heel reaches considerably beyond tip of snout; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to the body, heels greatly overlap. Skin of upper parts minutely glandular, with a narrow dorsolateral glandular line arising above the tympanum and ending in front of the groin in three or four beadlike enlargements; a narrow middorsal glandular line from snout to anus and an additional series of short \/- or)(-shaped glands from the occiput backward; a slight glandular line across the heel; ventral surface smooth except for postanal granulations extending below the femur; some enlarged glands at the corner of the mouth, and a diagonal ridge behind tympanum. (Apparently a pair of small lateral vocal sacs below the corners of the lower jaw in the male.)

Dimensions.—Head and body 33 mm.; head length 12 mm., width 11 mm.; femur 18 mm.; tibia 20 mm.; foot 19.5 mm.; hand 8.5 mm.

Color in alcohol.—Dorsum above wood brown, limbs lighter; a few small sepia spots scattered along the lower border of the dorsolateral line, and several more dark spots between the shoulders emphasizing the \/-shaped glandular lines; a faint dark triangular spot below the eye and dusky marks on the loreal region and behind the ear; femur with four even, dark crossbars above, which posteriorly break up into a marbled light and dark pattern with a few transverse irregular light bars; forelimbs, tibia and feet also crossbanded with dark; venter pale buff, immaculate.

Variations.—The other cotypes, also immature, do not differ essentially from the one described, nor does an immature topotype, USNM 96465. The largest topotype, 97762, apparently a female, measures 48 mm. in total length; USNM 97761 and 97763 are both 43 mm. long. These specimens are marbled drab to sepia in general tone; one shows wide light dorsolateral stripes, one has merely the suggestion of a light dorsolateral line, while the third is without any light marking in that region. The upper lip has three or four light diagonal stripes separating the dark area into irregular triangles, and the extreme tip of the snout is marked with a vertical light spot, while the edge of the lower lip is more or less distinctly dotted with white. A hemispherical lighter spot is dimly perceptible in front of the slightly darker interorbital bar. A dark anal patch is present; in one of the specimens a light sacral median line runs to the anus and branches below it into two postfemoral lines which widen and become irregular before fading out under the knee. A narrow light line, bordered by a dark one, crosses the heel, bordering the darker area under the tarsus. The chin and chest are clouded with gray dots, while the lower surfaces of the legs are sprinkled with small sepia spots.

The structure and proportions seem fairly constant in this species. The heel of the adpressed hind leg always reaches well beyond the snout tip, the tibia alone measuring between two-thirds and three-fourths of the length of head and body. The eye, while by no means small, is only about two-thirds the length of the snout, the extension of the snout apparently having taken place at the extreme tip. One of the topotypes, USNM 97761, has a very small tympanum, less than half the eye diameter, and consequently the disk of the third toe very nearly covers it. The tongue of this specimen is narrow, and oval and thick at the tip, whereas those of the other adults are spreading and thinner at the tip.

Remarks.—Although most Brazilian species of *Eleutherodactylus* live on the ground under leaves, the original series of seven cotypes, four of which are now in the Instituto Oswaldo Cruz, was collected among the leaves of a tree six feet from the ground at night. They were not difficult to catch, as they were not very active in spite of their long legs. The call is a *pr-r-r-r-r-r*, the last very sharply staccato and ending quickly, the first trilled.

Specimens examined

BRAZIL:

RIO DE JANEIRO: Nova Friburgo, grounds of Hotel Lemburger, USNM 96468–9 (cotypes of *Hylades nasutus*), A. Lutz and Venancio, Feb. 22, 1923; USNM 96465, A. Lutz, Feb. 14, 1932; USNM 97761–3, B. Lutz, Cochran, and Venancio, May 9–13, 1935.

Eleutherodactylus parvus (Girard)

PLATE 24, FIGURES H, I

1853. *Hylodes parvus* GIRARD, p. 423 (type locality, Rio de Janeiro); 1858, p. 63, pl. 3, figs. 24–28.—NIEDEN, 1923, p. 468.

1923. *Hylodes rhodopis* (not of Cope) MIRANDA-RIBEIRO, 1923c, p. 838; 1926, p. 57; 1929b, p. 39.
1944. *Eleutherodactylus parvus* B. LUTZ, 1944a, p. 1.—MYERS, 1946, pp. 11, 28.

Description.—Adult female, USNM 96807, Alto da Serra, São Paulo. Vomerine teeth in two large, slanting, widely separated patches far behind the choanae; tongue about one-half the width of mouth opening, elongate, oval, without a perceptible indentation on its very free posterior border; snout moderately long, broad and rounded when seen from above, slanting forwards to the upper lip edge in profile, the upper jaw not projecting beyond the lower; nostrils lateral, their distance from end of snout about one-half their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis very sharp, loreal region flat and slanting outwards to the flaring upper lip border. Eye small and not very prominent, its diameter contained 1¾ times in length of snout; interorbital diameter noticeably broad, two times the width of the narrow upper eyelid, and 1½ times the interval between the nostrils. Tympanum distinct only inferiorly, the upper half covered with skin, two-fifths the width of eye and separated from it by an interval nearly equalling its own diameter. Fingers free, very short, second a little longer than first and shorter than fourth, their tips scarcely dilated but slightly pointed and often grooved; no pronounced pollex, but metacarpal tubercles fairly well developed; toes free, their disks quite small, bilobed above but distinctly pointed; fifth toe slightly shorter than third, which extends to base of antepenultimate phalanx of the rather long fourth toe; a small but prominent inner and a scarcely visible outer metatarsal tubercle; faint glandular inner and outer metatarsal ridges. Body very short and stout, in postaxillary region wider than greatest width of head; when hind leg is adpressed, heel reaches only to anterior corner of eye; when limbs are laid along the sides, knee and elbow slightly overlap; when hind legs are bent at right angles to body, heels overlap. Skin of back slightly glandular, more heavily so on the sides; some pronounced tubercles on upper eyelids and in front of anus; a narrow sharp glandular dorsolateral line leaving the posterior eyelid and ending above the groin; no supratympanic glandular ridge, as the dorsolateral line passes above and well separated from it; a slight median dorsal glandular line; ventral surface smooth, except for the granular postanal region; apparently no external vocal sacs in the male. Size very small.

Dimensions.—Head and body 20 mm.; head length 8 mm., width 7.5 mm.; diameter of eye 2.5 mm.; femur 9.5 mm.; tibia 10 mm.; hind limb 29 mm.; fore limb 11 mm.; foot 8.5 mm.; hand 4 mm.

Color in alcohol.—Dorsum covered with minute wood-brown dots; suggestions of darker crossbands on femur and tibia; a seal-brown stripe along the canthus; a triangular, seal-brown, postanal patch sharply outlined anteriorly but fading out below the thighs; lower surface of tarsus between the tarsal ridges seal brown; ventral surfaces also covered with minute wood-brown dots on the throat and chest, immaculate posteriorly.

Variations.—The five other examples from Alto da Serra are very close to the described specimen in most details. The disks seem to vary a little in size, being scarcely enlarged on the toes in some cases and distinctly enlarged in others. The tympanum is less visible in the softer specimens, and in these also the dorsolateral folds are not apparent. Two of the frogs show a dark triangular patch under the eye. The general build, limb proportion, and head contour seem remarkably constant, however. The adpressed heel extends to the nostril in four and to the tip of the snout in one individual. The largest specimen, 22 mm. long, comes from Independencia, near Petrópolis. The coloration of all the specimens is very constant.

Remarks.—*Eleutherodactylus parvus* can be told from the young of other eleutherodactyli by the presence of the dark postanal triangular patch, as well as by its wide head and its very short, stout body. It is found in forests on the mountains near the city of Rio de Janeiro, living among the fallen leaves with *Leptodactylus marmoratus*, *Zachaenus parvulus*, and *E. guentheri*. Five very young ones from Tijuca, now bleached but presumably of this species, measure between 10 and 12 mm. in length.

The finger and toe disks of this species vary even more than usual for the genus. The tips may be bluntly rounded, or quite pointed when seen from above. The upper side of each tip may be a single, rounded, pillowlike or flat surface, but sometimes a median division may be apparent in some or most of the disks, so that they closely resemble those of *Basanitia lactea*. These two species are about the same size, and are superficially similar. *Basanitia lactea*, however, has a much larger eye in proportion to its snout length, and has only a slight darkening of the postanal region, instead of having a very distinct triangular patch, as in *parvus*.

While *parvus* of southeastern Brazil is quite clearly related to the Mexican *E. rhodopis* Cope, cotypes of which are in the U. S. National Museum, the former differs in having a prominent narrow dorsolateral ridge from eyelid to groin; in having a smaller eye, a broader interorbital width and a shorter snout, and a smaller size, the adult probably not exceeding 22 mm.

The first of the seven examples listed by Miranda-Ribeiro (1923c, p. 17) as *rhodopis* (MP 344, Raiz da Serra, São Paulo) is practically identical with the Rio de Janeiran topotypes of *parvus*. Hence it is positive that Miranda-Ribeiro's *rhodopis* refers only to *parvus*.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, USNM 96374–5, A. Lutz, 1927. Tijuca, USNM 119004–6, B. Lutz, November 1940; USNM 96303–4, A. Lutz, Mar. 5, 1934; USNM 96305–9, A. Lutz, December 1923.

Rio De Janerio: Angra dos Reis, USNM 96521–4, A. Lutz, April 1924. Bonito, Serra da Bocaina, A. Lutz, Dec. 30, 1931. USNM 96753–5, Independencia near Petrópolis, USNM 97561, B. Lutz, Cochran, and Venancio, May 5, 1935. Mountains near Rio de Janeiro, ZSBS (2), A. Lutz, 1932. Serra da Bocaina, ZSBS (2), A. Lutz, 1932. Teresópolis, ZSBS 7991, Bresslau, April 1914.

São Paulo: Alto da Serra, USNM 96806–11, A. Lutz, Mar. 6–9, 1926.

Eleutherodactylus unistrigatus holti **Cochran**

Figure 23

1948. *Eleutherodactylus unistrigatus holti* Cochran, 1948a, p. 1, fig. 1 (type locality, Alto Itatiaia, Rio de Janeiro).

Description.—The original description is reproduced, as follows:

Description of the Type: A.M.N.H. No. 17061, from Alto Itatiaya, Itatiaya, state of Rio de Janeiro, Brazil, collected in 1921 by E. G. Holt. Vomerine teeth in two small, transverse, well-separated patches behind the choanae and between their internal margins; maxillary teeth well developed; odontoids on the palatine bone weakly developed; tongue smooth, moderate in size, its width equaling one-half the mouth opening, notched and free posteriorly; a tooth-like process in front of lower jaw; snout semi-oval in outline when seen from above, rounding in profile, the upper jaw projecting beyond the lower; nostrils more lateral than superior, nearer to tip of snout than to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis blunt but well defined, the loreal region concave, the upper lip flaring out at an obtuse angle below it. Eye large, its diameter nearly equal to is distance from end of snout; interorbital diameter barely as great as that of the upper eyelid which is clearly

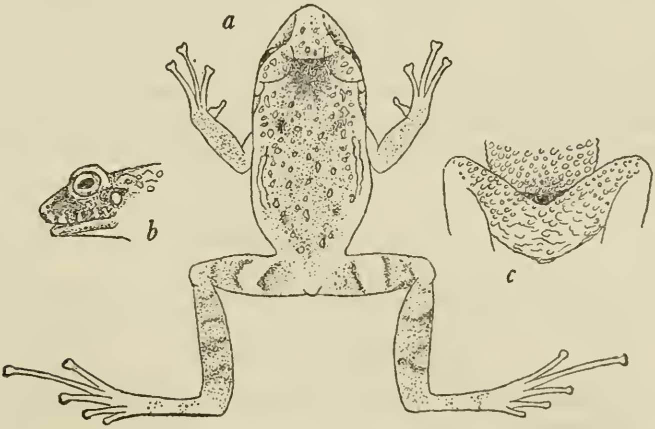


Figure 23.—*Eleutherodactylus unistrigatus holti*, AMNH 17061 (type): *a*, Dorsum × 2; *b*, profile × 2; *c*, posterior venter showing abdominal fold × 2⅛.

set off from the top of the head. Pupil elliptically transverse. Tympanum rather indistinct, small, its rim not very prominent, its diameter equal to one-third that of the eye, separated from eye by an interval equaling its own diameter. Fingers free, with small lateral ridges, the tips of the three outermost dilated into large disks, notched at the tips ("heart-shaped"), that of the third finger about equal to the tympanic area; tip of inner finger rounded and ball-like but scarcely dilated; fourth finger much longer than second, reaching nearly to base of disk of third; no rudiment of a pollex, but a well-developed callosity at base of first finger; subarticular tubercles on hands and feet moderate; toes free, with lateral ridges, all their disks enlarged and dilated, the tips of the third and fourth only bearing perceptible notches; disk of fourth toe about equal to that of third finger, covering the tympanic area; fifth toe somewhat longer than third, reaching to base of antepenultimate phalanx of fourth toe; a small oval inner metatarsal tubercle, and a larger round, outer one; a prominent round tubercle on heel, but no tarsal ridge. Body rather stout, in post-axillary region a little wider than the head. When hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the body, knee and elbow touch; when hind legs are bent at right angles to body, heels overlap considerably. Skin of upper parts heavily glandular with scattered warts on the back and a row of elongated warts in the dorsolateral region; a wide, low, supratympanic ridge; some small warts near edge of upper eyelids; chin slightly granular; belly and under surface of femur very coarsely granular, with a loose fold of skin bordering the edge of the granular area on the femur anteriorly and posteriorly; a very distinct ventral disk; the skin between this disk and the femoral granules quite smooth.

Dimensions: Head and body, 19 mm.; head length (snout tip to posterior tympanic area), 7 mm.; head width, 7.5 mm.; femur, 8 mm.; tibia, 10 mm.; foot (from base of inner metatarsal tubercle), 10 mm.; hand (from base of first finger), 6 mm.

Color (in Alcohol): Dorsum light sepia; a seal brown line between the upper eyelids, the area on the snout in front of this line paler; brown spots encircling some of the large warts on the back; coarse brown reticulations on posterior femur; venter immaculate fawn color.

Remarks.—This small frog from the slopes of Itatiaia, presumably the highest mountain in Brazil, shows a great similarity to *Eleutherodactylus unistrigatus* (Günther), known only from Ecuador and Bolivia. It differs in having wider upper eyelids and a narrower interorbital space, and in having the tibia, foot, and hand longer. These differences in physical proportions are best expressed by according subspecific rank to the Brazilian form *E. unistrigatus holti,* the type of which is unique.

Specimen examined

BRAZIL:

Rio de Janeiro: Alto Itatiaia, AMNH 17061 (type), Holt, 1921.

Genus *Elosia* Tschudi

1838. *Elosia* Tschudi, p. 77. (Genotype, *Hyla nasuta* Lichtenstein = *Elosia nasus* Boulenger.)

1843. *Scinacodes* Fitzinger, p. 32.

Generic diagnosis.—Pupil horizontal. Tongue subcircular, free behind. Vomerine teeth. Tympanum distinct. Fingers free, toes nearly free, the tips dilated into regular disks, the upper surface of which bears two rounded cutaneous divisions. Outer metatarsals united. Omosternum cartilaginous; sternum a cartilaginous plate. Terminal phalanges T-shaped.

The species *Elosia* do not differ very greatly from one another, yet the individuals of each species, where a series has been obtained, have been found to be fairly uniform in most of the characters which in some genera of frogs such as *Hyla* are subject to a very great degree of variability. The three recognized species of the genus *Elosia* (*E. divisa* Wandolleck appears to belong to the synonymy of *Eleutherodactylus guentheri* Steindachner) are separated by the following key.

Key to species of Elosia of southeastern Brazil

a^1. A glandular dorsolateral line; skin smooth . . . . . **lateristrigata** (p. 284)
a^2. No glandular dorsolateral line; skin more or less roughened by warts.
  b^1. Warts confined mostly to sides of body and legs; hand and foot shorter . . . . **nasus** (p. 287)
  b^2. Warts thickly scattered, especially on anterior part of back; hand and foot longer . . . . **aspera** (p. 282)

Many normally smooth individuals appear to have a roughened skin; encysted ectoparasites such as *Cercaria* were very abundant on almost every *Elosia* examined.

Girard's two specific names, *E. bufonium* and *E. vomerina*, were first published in 1853, with an amended description and plates five years later. Ever since, these descriptions have perplexed herpetologists, because subsequent collections of frogs from Rio de Janeiro failed to show any individuals that corresponded fully to the descriptions and figures of these two species.

A careful study of the cotypes of *vomerina* proves that they are in reality synonymous with *Crossodactylus gaudichaudii* (Duméril and Bibron). The vomerine teeth, said in the original description to be "disposed on a transverse line, interrupted in its middle, and placed on a level with the anterior margin of the inner nostrils", appear, in freshly collected specimens and in the cotypes of *vomerina* as well, to be merely a heavy ridge slanting inwards from the anterior borders of the choanae. Furthermore the first finger of the larger of the two cotypes, USNM 15481, shows a group of black spines, which is a distinguishing feature of *Crossodactylus* never found in *Elosia*.

A mix-up occurs also in the original description, where Girard (1853) states that *vomerina* has the legs "long and slender" when as a matter of fact they are relatively short. This error is still perpetuated in his (1858) amended description, which otherwise agrees quite well with the specimen except in one other matter: the spines at the base of the first finger are not mentioned in the redescription of *vomerina*, but instead appear at the end of the discussion of *bufonium*. The plate legend is likewise unfortunately mixed up, for his figure 39, said to be *nasuta* (=*nasus*) is in reality that of the larger cotype of *vomerina*, while his figure 17, said to represent *vomerina*, corresponds to USNM 67445, an example of *E. nasuta* which Girard had from the U.S. Exploring Expedition. His figure 26, representing the spiny first finger of *vomerina*, is wrongly attributed to *bufonium* in the legend. Apparently *bufonium* may be considered a synonym of *nasus*, since much subsequent collecting has revealed only the one form of *Elosia* from near the city of Rio de Janeiro, and it is fairly certain that the U. S. Exploring Expedition material comes from the immediate vicinity of the city. The type of *bufonium* is missing from the U.S. national collection. The synonymy of the type species, *nasus*, was worked out largely by the late Dr. Stejneger.

For a statistical analysis of measurements of the species of *Elosia* here discussed, see pages 373 and 383.

Elosia aspera L. Muller

FIGURE 24

1923. *Elosia nasus* (not of Lichtenstein) MIRANDA-RIBEIRO, 1923b (part), p. 815, pl. 3, figs. 1–7; 1926, p. 32 (specimens from Alto da Serra, São Paulo.)—DEWITT, 1930a, p. 221.

1924. *Elosia aspera* L. MÜLLER, 1924a, p. 173 (type locality, Barreira, near Teresópolis, Rio de Janeiro); 1927, p. 270.—A. LUTZ, 1931, pp. 234, 241.

Description.—Adult male, USNM 97833, from Alto da Serra, São Paulo. Vomerine teeth in two small, heavy, well-separated slanting patches between and behind the choanae; tongue nearly one-half the width of mouth-opening, oval, not indented on its free posterior border; snout rounded when viewed from above, truncate and slanting backwards to the upper lip border in profile, the upper jaw extending considerably beyond the lower; nostrils lateral, scarcely projecting, about halfway between eye and tip of snout, separated from each other by an interval 1½ times as great as their distance from eye. Canthus rostralis sharply defined, the loreal region vertical and concave, similar to that of *E. nasus*. Eye large and prominent, its diameter equal to its distance from end of snout; interorbital diameter equal in width to the broad upper eyelid, about two-thirds that of distance between nostrils. Tympanum large and distinct, about one-half the diameter of eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, their tips dilated into disks twice the width of terminal phalanx, with a pair of distinct pads separated by a longitudinal furrow on top of each disk; fourth finger much longer than second which reaches to base of penultimate phalanx of third; first finger shorter than second; no pronounced pollex; a large round palmar tubercle, and a smaller elongate one on base of first finger; toes (described from USNM 96630) all slightly webbed; disks of toes like those of fingers and similar in size; fifth toe shorter than third, which extends to base of antepenultimate phalanx of fourth; a small but distinct inner metatarsal tubercle, and a very small round outer one; subarticular tubercles of fingers and toes small, single, but distinct; a heavy dermal fold on outer and inner tarsal region, and dermal fringes on fingers and toes. When leg is straightened, a heavy skinfold appears on the heel and knee. Body stout, in postaxillary region a little wider than head; when hind leg is adpressed, heel reaches to tip of snout; when limbs are laid along the sides, knee and elbow greatly overlap; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts coarsely granular, with large tubercles especially prominent along the sides of the body from above tympanum to groin, on coccyx, and on posterior femoral area; ventral surfaces smooth; a heavy ridge along upper tympanum from eyelid onto shoulder. A pair of lateral external vocal sacs that, when deflated, form a loosely creased skin pocket just in front of each shoulder.

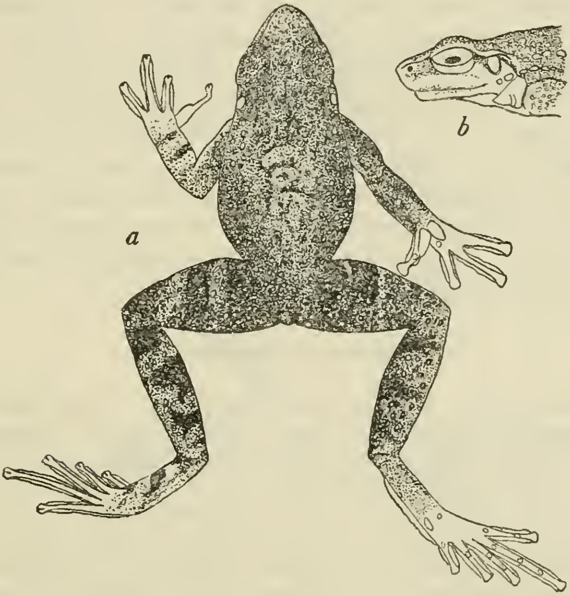


FIGURE 24.—*Elosia aspera*, USNM 97833: *a*, Dorsum; *b*, profile; both × 1.

Dimensions.—Head and body 42 mm.; head length 15 mm., width 14 mm.; femur 21 mm.; tibia 22.5 mm.; foot 20 mm.; hand 14 mm.

Color in alcohol.—Above cinnamon brown with small darker brown spots on the back, and wide, dark crossbars on the legs; tubercles light, almost white. Venter white, except for a narrow gray longitudinal line in the center of the throat midway between the vocal pouches. Soles of feet and palms of hands cinnamon brown, the subarticular tubercles whitish. Upper lip pale brown mottled with darker brown; a dark brown patch on shoulder just below vocal pouches.

Variations.—In a freshly caught series from Boracea, São Paulo, the upper eyelids are dark, and a dark U-shaped mark often extends backward from the eyelids onto the center of the back. An angular dark patch often occurs just behind the tympanum. The white dots of the tubercles are very apparent on the sides. The anterior femur has the edges of the brown crossbars more or less outlined with white, and the tibial bars only slightly less set off with a light tone.

Remarks.—This form apparently replaces *Elosia nasus* in the inland mountain ranges. It is much like *nasus* except that the skin of the back, especially the anterior part, is noticeably more tubercular, while *nasus* has the skin of this region glandular and fairly smooth. In general, the eye of *aspera* is a trifle larger in comparison to the snout, but this does not hold in every case. The canthus rostralis is about equally sharp in both species.

Specimens examined

BRAZIL:

Rio de Janeiro: Angra dos Reis, USNM 96525–38, A. Lutz, 1924. Barreira, near Teresópolis, ZSBS 2106–7, Bresslau, Mar. 2, 1914. Bonito, Serra da Bocaina, USNM 96627–32, 96761–2, A. Lutz, 1928–31. Petrópolis, USNM 96414, A. Lutz, Oct. 17, 1928; USNM 96415, A. Lutz, Aug. 18, 1927; USNM 96427, A. Lutz, Nov. 20, 1926, USNM 97650, 101137, B. Lutz, Cochran, and Venancio, May 5, 1935. Serra da Bocaina, USNM 81153, A. Lutz, 1930. Teresópolis, ZSBS (1), Bresslau, April 1914; USNM 96457, A. Lutz, Nov. 9, 1930. Travasso, Serra de Angra, USNM 97220–8, Werneck, March 1932.

Santa Catarina: Humboldt, ZSBS 44/1922 (5), 45/22 (8), 46/22 (4), Erhardt, 1918–19.

São Paulo: Alto da Serra, USNM 96836, A. Lutz; USNM 97831–40, Cochran and Venancio, Apr. 25–26, 1935; USNM 102312. Boracea, DZSP 1751, 1754, 1756, 1758, 1760, 1762, 1765, 1769, 1781–2, 1789, 1795, 1798–9, 1801, 1804, 1811, 1813–5, Bokermann, 1947–8. São Paulo, USNM 129151–5, Vanzolini and Bokermann, Dec. 12–19, 1947. Serra de Cubatão, ZSBS (1), A. Lutz, 1924.

Elosia lateristrigata Baumann

Figure 25

1912. *Elosia lateristrigata* Baumann, pp. 89, 161, pl. 4, figs. 1–1,b (type locality, Organ Mountains, Rio de Janeiro).—Miranda-Ribeiro, 1923b, p. 818; 1926, p. 31, fig. 16, pl. 4, figs. 2–2,b.—Nieden, 1923, p. 404, fig. 307.—Mertens, 1930, p. 161.—A. Lutz, 1931, p. 232.

1926. *Elosia glabra* Miranda-Ribeiro, p. 31 (type locality, Itatiaia, Rio de Janeiro).

Description.—Adult male, USNM 96765, Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two short, heavy, transverse, well-separated patches behind the posterior borders of the choanae; tongue a little more than half as wide as mouth-opening, oval, slightly indented on its free posterior border; snout obtusely angular when viewed from above, slanting backwards towards the lip border in profile, the upper jaw consequently extending far beyond the lower; nostrils lateral, not projecting, their distance from end of snout about four-fifths that to eye, separated from each other by an interval about twice as great as their distance from eye. Canthus rostralis sharp and well defined, forming a right angle with the vertical loreal region, which appears slightly concave because of the curving upper lip beneath it. Eye large and prominent, its diameter very slightly less than its distance from end of snout; interorbital diameter equal to width of the broad upper eyelid, about two-thirds that of distance between nostrils. Tympanum large and very distinct, about one-half the diameter of the eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, their tips dilated with disks only slightly wider than the terminal phalanx, which is equipped (in this specimen) with wide dermal fringes; a pair of distinct pads separated by a median longitudinal furrow on top of each disk, even the first; fourth finger much longer than second, which reaches only to base of penultimate phalanx of third; first finger very slightly shorter

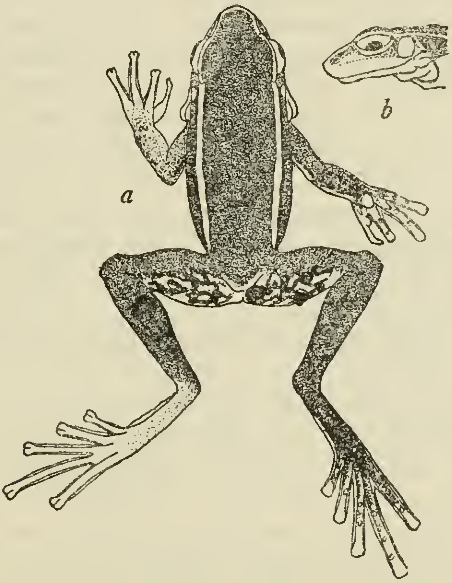


Figure 25.—*Elosia lateristrigata*, USNM 96765: *a*, Dorsum; *b*, profile; both × 1.

than second; no prominent pollex, but a wide low palmar tubercle which gives off projections to the three outer digits, and a similar swollen tubercle on outer side of first finger; toes slightly webbed at the base, their disks like those of fingers and similar in size; third and fifth toes subequal, reaching to middle of antepenultimate phalanx of fourth; a small sharp oval inner and smaller round outer metatarsal tubercle; a distinct dermal fold along inside of tarsus, and well-marked fringes on fingers and toes (in this specimen); when leg is straightened, a heavy skinfold appears at heel and knee. Body somewhat more slender than in *E. nasus*, in postaxillary region equal to width of head; when hind leg is adpressed, heel reaches to between nostril and tip of snout; when limbs are laid along sides, knee and elbow greatly overlap; when limbs are bent at right angles to body, heels overlap. Skin of upper parts minutely glandular, smooth on back and sides except for the heavy glandular dorsolateral fold which extends backwards from posterior eyelid to groin, and forwards on outer border of eyelid, merging with canthus rostralis. Entire surface of limbs smooth excepting for the postanal region and posterior femur, which are minutely granular; throat, chest, and belly perfectly smooth. A pair of very conspicuous external vocal sacs below the outer corner of the lower lip.

Dimensions.—Head and body 39 mm.; head length 14 mm., width 12.5 mm.; femur 19 mm.; tibia 21 mm.; foot 20 mm.; hand 12 mm.

Color in alcohol.—Ground color above uniform seal brown, lightening somewhat on the limbs; a white stripe beginning on the tip of the snout, extending on the canthus rostralis and following the glandular fold along the outer eyelid and dorsolateral region, where it widens considerably at the groin, and is continued along the anterior femur to the knee, the lower (anterior) margin of this femoral stripe being distinctly set off with a sepia stripe, but posteriorly fading gradually into the color of the upper femur; ventral region pale buff, immaculate except for some small sepia spots on the belly and on the lower tibia; the dark sepia lateral area quite sharply separated from the light belly; posterior femur heavily marbled with sepia and buff, the buff areas tending to form wavy longitudinal lines concentrating below the knee.

Variations.—The five other males from Bonito are like the described specimen, except that they have a medium longitudinal dark stripe on the throat, with some scattered spots on chin and throat as well as on anterior part of belly and lateroventral region.

Some females display a different coloration; four of the five from this same series are heavily mottled over the entire ventral surfaces, even on the limbs, while the anterior femoral stripe is reduced to a few small, pale, irregular spots, the upper and anterior femur being crossed diagonally by several dark bars. The fifth female is colored like the majority of the males. All the Serra da Bocaina specimens, male and female, have the lateral stripe present and agree well in every structural feature, so that it is evident that all belong to the same species in spite of color variations. The dermal fringes on fingers and toes are prominent in one or two individuals, and well developed in the remainder.

The 10 males from Boracea all have the venter fairly heavily mottled with black, and the anterior femoral stripe is not in evidence. The single male from Ibití has the venter nearly white, and a very distinct antefemoral stripe. A comparison of interorbital width to upper eyelid shows that this ratio varies greatly even in frogs from the same locality, so that it is valueless as a differentiating character. As the critical body proportions, color, and other characters are similar in *lateristrigata* and *glabra*, the two forms are here considered as synonymous.

Specimens examined

BRAZIL:

Rio de Janeiro: Barreira, near Teresópolis, ZSBS 20/19 (2) and 58/22 (2), Bresslau, 1914. Bonito, Serra da Bocaina, USNM 96633, 96765–75, A. Lutz, 1928–31. Montserrat, Serra do Itatiaia, AMNH 17019–20, Serra das Orgãos, ZSBS 24/1923 (cotype of *E. lateristrigata*), Goeldi; ZSBS 65/47, A. Lutz, 1932. Serra da Bocaina, USNM 81154, 96618, 96620–2, A. Lutz. Teresópolis, USNM 101720, Miranda-Ribiero; BM 93.9.23.1–2, A. E. Goeldi; ZMB 27494.

São Paulo: Alto da Serra, MRHN IG 9308 Reg. 48, 48b, Massart, 1922. Boracea, DZSP 1694–5, 1697, 1699, 1701–2, 1707, 1712–3, 1715, Vanzolini and Bokermann, Dec. 12–19, 1947. Ibití, DZSP 2334, J. L. Lima, 1946. Pereque, BM 1901.3.1.12, A. Robert.

Elosia nasus **(Lichtenstein)**

Figure 26; Plate 24, Figures j, k

1823. *Hyla nasus* Lichtenstein, p. 106 (type locality, Brazil).
1824. *Hyla ranoides* Spix, p. 32, pl. 6, fig. 3 (type locality, Bahia).—Peters, 1873a, p. 207.
1826. *Hylodes ranoides* Fitzinger, p. 64.
1838. *Elosia nasuta* Tschudi, p. 77 (type locality, Brazil).—Girard, 1858, p. 65, pl. 4, fig. 17.
1853. *Elosia bufonium* Girard, p. 423; 1858, p. 68, pl. 4, fig. 23.
1864. *Hylodes truncatus* Steindachner, 1864a, p. 248, pl. 17, figs. 3, 3,a (type locality, Corcovado, Rio de Janeiro).
1882. *Elosia nasus* Boulenger, 1882a, p. 193; 1888c, p. 416.—Steindachner, 1907, p. 1540.—Wandolleck, 1907, p. 3.—L. Müller, 1922, p. 170; 1927, p. 269.—Nieden, 1923, p. 403, fig. 306.—Miranda-Ribeiro, 1923b, p. 815; 1926, p. 32, fig. 17, pls. 2, 3 (specimens from Rio de Janeiro). —deWitte, 1930a, p. 221.—A. Lutz, 1931, p. 230.—Mello-Leitão, 1937, p. 329.
1912. *Elosia bufonia* Baumann, p. 161.
1926. *Elesia* (sic) *nasus* Brazil and Vellard, 1926, p. 43.

1929. *Elosia nana* (sic) LUEDERWALDT, p. 39.
?1929. *Elosia ranoides* LUEDERWALDT, p. 39.
1931. *Basanitia lactea* (not of Miranda-Ribeiro) A. LUTZ, p. 239, pl. 65, figs. 10, 11 (tadpole and caudate frog).
1946. *Hylodes nasus* MYERS, pp. 10, 28.

Description.—Adult female, USNM 96258, Tijuca, city of Rio de Janeiro. Vomerine teeth in two small, heavy, narrowly separated, nearly straight patches between and slightly behind the posterior borders of the choanae; tongue slightly more than half as wide as mouth-opening, oval, not indented on its free posterior border; snout rounded when viewed from above, slanting backwards towards the lip border in profile, the upper jaw consequently extending far beyond the lower; nostrils lateral, scarcely projecting, their distance from end of snout about three-fourths that of eye to snout, separated from each other by an interval almost twice as great as their distance from eye. Canthus rostralis sharply defined, the loreal region vertical and appearing slightly concave because of the flaring out of the upper lip below it in a distinct curving arch, leaving an arc-shaped channel along the lower loreal region. Eye very large and prominent, its diameter equal to its distance from end of snout; interorbital diameter equal to width of the broad upper eyelid, about two-thirds that of distance between nostrils. Tympanum large and very distinct, about two-thirds the diameter of the eye, separated from eye by an extremely narrow interval scarcely equal to one-fifth its own diameter. Fingers free, their

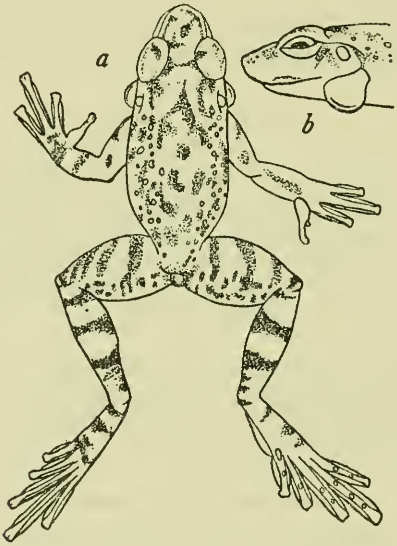


FIGURE 26.—*Elosia nasus*, USNM 96371: *a*, Dorsum; *b*, profile; both × 1.

tips dilated into disks twice the width of terminal phalanx, with a pair of distinct pads separated by a median longitudinal furrow on top of each disk, even the first; fourth finger considerably longer than second, which reaches only to base of penultimate phalanx of third; first and second fingers nearly equal, or first slightly shorter than second; no pronounced pollex, but a wide, low palmar tubercle and one on outer side of first finger; toes with slight traces of a web between all except the outer two; disks of toes like those of fingers and similar in size; fifth toe shorter than third, which extends midway on antepenultimate phalanx of fourth; a small but sharp oval inner metatarsal tubercle and a smaller round outer one; subarticular tubercles of fingers and toes small, single, inconspicuous; a very distinct dermal fold along inside of tarsus but no fringes on fingers and toes (in this specimen); when leg is straightened, a heavy skinfold appears at heel and knee. Body stoutly built, in postaxillary region a little wider than head; when hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow considerably overlap; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts minutely glandular, with small flat tubercles appearing above the ear and on the dorsolateral regions, and becoming more prominent before the groin and tending somewhat to a definite lateral line arrangement; posterior thighs and postanal region covered with small granules; ventral surfaces smooth; a narrow, low glandular line encircling upper tympanic border and ending behind it on the shoulder. (The male has a pair of small external vocal sacs below the outer corner of the lower lip; otherwise the sexes look alike.)

Dimensions.—Head and body 38 mm.; head length 14 mm., width 13 mm.; femur 18.5 mm.; tibia 20 mm.; foot 17.5 mm.; hand 11.5 mm.

Color in alcohol.—Ground color above dark olive, lightening to drab on the limbs; a broken seal-brown crossband between the eyes, with a light spot in front of and behind it on either eyelid; an irregular dark brown spot on top of the snout; back with very indistinct dark suffusions and a few small light spots; the enlarged tubercles on the side in front of the groin white (yellowish in life); upper part of femur, tibia, and outer tarsus with wide symmetrical sepia crossbars; posterior femur with very fine gray vermiculations on a drab ground; a dark diagonal bar on the front of the forearm; upper arm with indistinct crossbars and fine reticulations; ventral surfaces pale drab gray with slight suffusions of darker reticulations all over, especially on lower thighs.

Variations.—In other adult individuals from the vicinity of the city of Rio de Janeiro the canthus rostralis is sharp, while the nostril is often a little nearer to the tip of the snout, about two-thirds the distance from the eye, instead of midway, as in the described specimen.

While the specimen described lacks the membranous fringes along the sides of fingers and toes, in the majority of cases this fringe is represented by only a dermal ridge, although it is distinctly developed in some examples. The belly and throat of most of the specimens are heavily reticulated, the dark pigment seeming to concentrate in a dark irregular patch on the center of the throat. In the specimens in which the reticulation of the under surfaces is absent, a dark longitudinal spot still persists on the throat. The scattered white warts on the sides are present in all the specimens, but in only a little more than half is there a slight indication of their being arranged in a lateral line in front of the groin. The back is usually free from warts, and the skin is fairly smooth, although thick and glandular. In this respect the Rio de Janeiro frogs differ from the species called *E. aspera* by Müller, which apparently has a much rougher skin, especially on the anterior dorsal region.

A striking dissimilarity in the toe length of the same individual is noticeable in USNM 96349. In this frog the fourth toe on the left foot measures 19 mm. from base of metatarsal tubercle, while that of the right foot is only 17 mm. long, there being no apparent malformation to account for the difference. The shortening has taken place in the last and penultimate phalanges only. The other toes are the same length on both feet. (I have used the greatest foot length whenever there was a dissimilarity.)

Remarks.—The tadpole and two metamorphic frogs from Tijuca which served as the basis for A. Lutz's remarks and figures for the supposed young of *Basanitia lactea* prove to be young *Elosia nasus*, since the disks of the first finger and first toe are plainly divided on top in the two examples which have developing legs. The specimens are entirely bleached, so that no pattern appears. These two metamorphic frogs measure 22 and 24 mm., respectively, from tip of snout to anus, while a tadpole of *nasus* from Corcovado with well-developed hind legs, and forelegs ready to break through the skin of the breast, measures 23 mm. The difference in size is negligible.

Specimens examined

BRAZIL: MHNP 779, 4895, Gaudichaud.

Amazonas: Teffé, ZSBS 1044/0 (2), Spix.

Bahia: ZSBS 1043/0 (2; cotypes of *Hyla ranoides* (?)), Spix.

Districto Federal: Corcovado, USNM 96329–31, A. Lutz, 1921–2. Paineiras, slope of Corcovado, USNM 96346, A. Lutz, Nov. 13, 1923. Rio de Janeiro, USNM 81150–2, 96349–50, 96371–3, A. Lutz; USNM 67445–6, U. S. Exploring Expedition, 1852; ZSBS (12), A. Lutz, 1924. Tijuca, USNM 96258–61, A. Lutz and Venancio, Mar. 5, 1934; USNM 96271 (3 tadpoles), A. Lutz, December 1922; MZUM 104242, Bailey, 1941.

Rio de Janeiro: Barro Branco, MZUM 104244, Bailey, 1941. Teresópolis, MHNP 07-226–7, Steindachner.

Genus *Eupsophus* Fitzinger

1843. *Eupsophus* Fitzinger, p. 31. (Genotype, *Cystignathus roseus* Duméril and Bibron).
1843. *Borborocoetes* (not of Schoenherr 1842) Bell, p. 34.
1843. *Ololygon* Fitzinger, p. 31.
1865. *Thoropa* Cope, 1865b, p. 110.
1865. *Eusophus* Cope, 1865b, p. 113.
1928. *Borborocoetea* Strand, p. 55.

Generic diagnosis.—Pupil horizontal. Tongue subcircular, entire or slightly nicked and free behind. Vomerine teeth. Tympanum more or less distinct or absent. Fingers free; toes free or nearly so, the tips not dilated. Outer metatarsals united. Omosternum cartilaginous; sternum a cartilaginous plate. Terminal phalanges simple or slightly bifurcate.

For a statistical analysis of measurements of the species of *Eupsophus* here discussed, see pages 373 and 383.

Key to species of Eupsophus of southeastern Brazil

a 1. Thumb spines very small, in 2 patches.
  b 1. Snout nearly semicircular when seen from above; no spines on second and third fingers; venter immaculate; size small (about 28 mm.). **lutzi** (p. 291)
  b 2. Snout broadly oval; spines on second and sometimes on third fingers; venter with small dark spots on throat, chest and chin; size large (up to 78 mm.) . . . . **miliaris** (p. 293)
a 2. Thumb spines relatively large, in a single patch of 6 to 10; snout bluntly rounded; venter with small spots on throat and belly; size small (25 mm.). **petropolitanus** (p. 298)

Eupsophus lutzi (Cochran)

Plate 25, Figures a, b

1938. *Thoropa lutzi* Cochran, p. 41 (type locality, Recreio dos Bandeirantes, Rio de Janeiro).
1946. *Eupsophus lutzi* Myers, pp. 11, 28.

Description.—Adult male, USNM 97622, Recreio dos Bandeirantes, Districto Federal. Vomerine teeth in two long, slender, posteriorly converging series well separated medially, lying between the choanae; maxillary teeth well developed; tongue one-third as wide as mouth-opening, oval, with a slight indentation on its nearly entirely attached posterior border; a single toothlike process in front of lower jaw; snout well rounded, almost semicircular when seen from above, its tip bulging and very bluntly rounded in profile, the upper jaw projecting slightly beyond the lower; nostrils superolateral, strongly projecting, their distance from end of snout about one-third that to eye, separated from each other by an interval equal to their distance from eye.

Canthus rostralis prominent but rounded, the loreal region concave and slanting outwards to the flaring upper lip border. Eye very large and prominent, its diameter equal to its distance from end of snout; interorbital diameter equal to width of upper eyelid, equal to distance between nostrils. Tympanum very distinct, one-half the width of the eye, separated from eye by an interval less than one-third its own diameter. Fingers free but with slight lateral dermal ridges, their tips distinctly enlarged but truncate so that the terminal phalanx is almost triangular, not grooved; fourth finger much longer than second, which reaches to base of penultimate phalanx of third; first finger very short, its terminal phalanx in preservative bent at right angles to second, which bears a conspicuous round swelling beset with very numerous minute horny black tubercles; a similar but smaller patch of tubercles on the swollen basal callosity; subarticular and palmar tubercles well developed; toes without webs but with slight lateral ridges, their disks smaller than those of fingers and more rounded, third longer than fifth, reaching halfway on antepenultimate phalanx of fourth; a prominent oval inner and a small round outer metatarsal tubercle; tarsal ridge not apparent. Body moderately slender, in postaxillary region narrower than greatest width of head; when hind leg is adpressed, heel reaches beyond tip of snout; when limbs are laid along the body, knee and elbow greatly overlap; when hind legs are bent at right angles to body, heels slightly overlap. Skin of upper parts nearly smooth (minutely glandular under microscope) except for encysted *Cercaria* in this specimen; a slight supratympanic ridge ending in a short enlargement above the shoulder; posterior surface of femur slightly granular; ventral surfaces smooth. No external vocal sac apparent.

Dimensions.—Head and body 27.5 mm.; head length 10 mm., width 10.5 mm.; femur 14.5 mm.; tibia 15.5 mm.; foot 12.5 mm.; hand 8 mm.

Color in alcohol.—Dorsum russet, with a chocolate, light-edged triangle between the eyes. an irregular rounded chocolate mark enclosing a light center between the shoulders, and some indistinct dark suffusions across the sacrum; upper surfaces of limbs pinkish buff with fairly regular square cinnamon spots, three on femur, three on tibia, and several on tarsus; posterior surface of femur with small dark spots on a buff ground; ventral surface immaculate cream buff; the two patches of minute spines on the thumb black; upper lip pale buff with indistinct darker spots.

Variations.—The other adult males do not vary much from the described specimens. The heel reaches to the tip of the snout in two, beyond the snout in two, and to between the eye and the nostril in one. The skin is naturally rough in three, without this being due to scars left by ectoparasites. All the males have two similar patches of minute spines on the thumb, the smaller patch at the base, the larger on the penultimate phalanx. A young frog measuring 16.5 mm. lacks these spines.

The color pattern is quite constant, with the large dark triangle between the eyes preceded by a light and a dark crossbar. The region between the shoulders has a median light area bordered by an irregular dark circle or merely with some dark markings on its anterior border. The posterior half of the back tends to be very indistinctly mottled with dark. The regular rectangular dark spots across the legs are evident in all specimens that are not completely faded out.

Remarks.—This species is similar to *Eupsophus miliaris* but much smaller; the snout nearly semicircular when seen from above; thumb spines very minute, in two patches on first, but not appearing on second and third fingers as in *miliaris;* ventral surface immaculate. The species was named in honor of Dr. Adolpho Lutz.

Specimens examined

BRAZIL:

Rio de Janeiro: Independencia, Petrópolis, USNM 96422–3, A. Lutz, 1926.

Districto Federal: Recreio dos Bandeirantes, USNM 97622 (type of *E. lutzi*), and 97623 (paratype), B. Lutz, Cochran, and Venancio, Feb. 9, 1935. Rio de Janeiro, Sumaré, USNM 97327–8, A. Lutz, Feb. 15, 1924. Tijuca, USNM 96297–8, A. Lutz.

Some young frogs, USNM 97437–40, and eggs, USNM 97441, Paineiras, Districto Federal, B. Lutz and Cochran, Jan. 27, 1935, may belong to this species.

Eupsophus miliaris (Spix)

Plate 25, Figures c–h

1824. *Rana miliaris* Spix, p. 30, pl. 6, fig. 1 (type locality, "Amazonflus").

1842. *Cystignathus missiessii* Eydoux and Souleyet, p. 148, pl. 10, figs. 2–2,b (type locality, Eijouja).

1860. *Ololygon abbreviatus* Fitzinger, p. 413.—Steindachner, 1867, p. 65, pl. 4, figs. 16–18.

1861. *Eupsophus fuliginosus* Fitzinger, p. 414 (type locality, Brazil).—Parker, 1932, p. 342.

?1862. *Cystignathus discolor* Reinhardt and Lütken, p. 169 (type locality, Juiz de Fóra, Minas Gerais).

1865. *Thoropa missiessii* Cope, 1865b, p. 110.

1867. *Hylodes abbreviatus* Hensel, p. 151.—Gadow, 1901, p. 209.—Brandes and Schoenichen, 1901, p. 458.

1873. *Ololygon miliaris* Peters, 1873a, pl. 206.

1882. *Thoropa miliaris* Boulenger, 1882a, p. 331; 1886b, p. 443.—Gadow, 1901, p. 209.—Brandes and Schoenichen, 1901, p. 404.—Travassos, 1945, p. 501.—B. Lutz, 1947, p. 246.

1891. *Borborocoetes miliaris* Boulenger, 1891b, p. 454.—Werner, 1897b, p. 266.

1907. *Hylodes miliaris* Wandolleck, p. 5, figs. a–c, pl. 1, figs. 3–3,b.—Baumann, 1912, p. 161.—Nieden, 1923, p. 463.—Miranda-Ribeiro, 1923c, p. 844, pl. 1, a–c, pl. 3.

1912. *Leptodactylus discolor* Baumann, p. 162.—Nieden, 1923, p. 492.—Miranda-Ribeiro, 1927, p. 114.
1917. *Eleutherodactylus miliaris* Noble, p. 793.—L. Müller, 1927, p. 274.
1923. *Ololigon abbreviatus* Miranda-Ribeiro, 1923c, pp. 840, 844, 1 pl.
1923. *Ololigon abbreviatus taophora* Miranda-Ribeiro, 1923c, p. 844 (type locality, Alto da Serra, São Paulo).
1923. *Hylodes discolor* Nieden, p. 492.
1926. *Ololigon miliaris taophora* Miranda-Ribeiro, p. 61.
1929. *Hylodes abbreviatus tanophora* (sic) Luederwaldt, p. 39.
?1929. *Platymantes abbreviatus* Luederwaldt, p. 39.
1930. *Hylodes brieni* deWitte, 1930a, p. 223, pl. 4, fig. 3, pls. 5, 6 (type locality, Itaeté, Bahia).
1937. *Epsophus miliaris* Miranda-Ribeiro, 1937d, p. 67.
1946. *Eupsophus miliaris* Myers, pp. 11, 28.

Description.—Adult male, USNM 97765, Novo Friburgo, Rio de Janeiro. Vomerine teeth in two heavy, short, nearly contiguous patches between the posterior choanal borders; maxillary teeth well developed; tongue over two-thirds the width of mouth-opening, rounded, free behind and with a very slight indentation; a small toothlike process in front of lower jaw; snout broadly oval when seen from above, truncate in profile, the upper jaw projecting considerably beyond the lower; nostrils lateral, strongly projecting, their distance from end of snout one-third that from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis prominent, the loreal region flat, the upper lip flaring out below it. Eye large, its diameter two-thirds its distance from end of snout; interorbital diameter about 1⅓ times that of upper eyelid, equal to distance between the nostrils. Tympanum very distinct, two-thirds the width of eye, separated from eye by an interval equal to two-thirds its own diameter. Fingers free but with distinct lateral dermal ridges, their tips slightly widened, truncate, not grooved; fourth much longer than second, which reaches to base of penultimate phalanx on third; first and second subequal; second phalanx of first finger bearing some minute black tubercles in the male, with a much larger pad of tubercles on the basal part and a few scattered tubercles along the corresponding parts of the second finger; subarticular and palmar tubercles well developed; toes unwebbed, but with distinct lateral dermal ridges, their disks slightly larger than those of fingers, third a little longer than fifth, reaching to base of antepenultimate phalanx of fourth; a medium-sized inner and a small, weak, outer metatarsal tubercle; no tarsal ridges. Body rather stout, in postaxillary region a little narrower than greatest width of head. When hind leg is adpressed, heel reaches to nostril; when limbs are laid along the body, knee and elbow overlap; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts coarsely glandular, the glands becoming elongate and wartlike on the sides of the body; a very heavy supratympanic ridge leaving posterior corner of eye and ending on the shoulder; posterior surface of femur finely granular; skin of lower parts finely shagreened; no ventral disk or throat fold. Upper arms very strongly developed.

Dimensions.—Head and body 78 mm.; head length 27 mm., width 30 mm.; femur 27 mm.; tibia 38 mm.; foot 37.5 mm.; hand 21 mm.

Dimensions of the type of *Ololigon abbreviatus taophora*, MP 432, are: Head and body 46 mm.; head length 17.5 mm., width 19 mm.; femur 24.5 mm.; tibia 27 mm.

Color in alcohol.—Dorsum drab to fawn color with a wide chocolate band between the eyes, and two large, more or less rectangular chocolate rhombs on the back, their anterior and posterior edges accented with pearl gray. A dark brown loreal stripe, continued behind the eye and below the tympanum, the rest of the upper lip pearl gray, with a brown mottling towards the mouth-opening. Supratympanic ridge outlined with dark brown. Legs and arms ecru-drab with coarse, irregular, chocolate patches becoming fairly regular crossbars on the tibia. Venter buff, with small darker spots scattered over throat, chin, and chest. Posterior femur buff, with irregular brown mottlings; a fairly distinct dark anal patch. Tips of toes and fingers pale buff, palms and soles darker. Sides of body with fine brown reticulations on a buff ground.

Color in life.—The coloration of a living specimen from Tijuca, USNM 97415, was as follows: Iris bright ochraceous rufous, almost dragons-blood red below; dorsum dark olive-buff to greenish drab, with dark seal-brown mottlings; upper lip bright olive-buff, a black line on canthus and on edge of lip; a bright olive-yellow spot behind axilla on right side only; venter dark fawn color posteriorly, light clove brown anteriorly, with white vermiculations; femur with black crossbands, its posterior surface spotted with lemon or olive-yellow. A smaller specimen, USNM 97416, is similar but lighter, and without so much dark mottling above.

Variations.—The variations in critical characters have been recorded for the 22 adults in the U. S. National Museum as well as in the 4 belonging to the Museu Paulista. All efforts to correlate geographic distribution with variation in any definite character were unavailing. Measurements and characters of the most northerly frogs from Espírito Santo and Minas Gerais fell entirely within the limits of those from Rio de Janeiro and São Paulo. The tympanum may be two-thirds to four-fifths the eye diameter, separated from the eye by an interval between one-quarter and three-quarters of its own diameter, without regard to locality. The median dorsal skin is usually granular, but often fairly smooth, while the lateral region is heavily tubercular or only moderately granular. The ventral disk may be weakly or very strongly developed. Spines on the hands seem to develop only in frogs above 30 mm. in length, but beyond that point the development is relatively independent of the size and age of the male, since a 38 mm. frog (the smallest having spines in the present series) has about 30 spines on the first finger, while the largest male, 77 mm. long, has only about 50 spines, the maximum number of about 120 spines being attained by a male 62 mm. in length. There is a well-developed patch of spines on the pollex in all males; these vary between 7 and 20 in number without regard to the body size. The second finger has between 3 and 13 spines scattered on all of its phalanges, while the third finger may have as many as 10 spines, although occasionally they are entirely lacking here. Sometimes the spines are pale and weak; this is true of the largest male, collected in Nova Friburgo, on May 9, and of a 64 mm. individual, collected at Recreio dos Bandeirantes, on the coast, on February 18; so it cannot be due to the time of year in reference to breeding season, as the species is still breeding in February. Some of the spines in all the finger patches are smaller than others; this seems to indicate that new ones are growing all the time, as I have shown to happen in the genus *Crossodactylus*. The number of spines in *miliaris*, however, is apparently far more variable than in any of the known species of *Crossodactylus*.

The adpressed heel may reach beyond the snout, to tip of snout, to nostril, or to between eye and nostril. The first and second fingers are often very nearly subequal, while the first is sometimes slightly longer. This comparison is very difficult to make in males, as the distal phalanx contracts at right angles in preservative, so that it is not always possible to make an accurate measurement.

In color pattern there is no fixity as to the T-shaped mark on the head, as this pattern is found without regard to geographic distribution in most of the specimens at hand. Some have the T reduced to a ∇, and sometimes even this is reduced to a dark line representing its anterior margin. The spots following this along the back are sometimes fairly rectangular, but are often very irregular, sometimes light-centered. The throat and anterior chest are usually brown with numerous small white spots. In a few specimens only the throat is so patterned, while in one or two others the maculation extends over the anterior part of the abdomen. In two specimens from São Paulo, as already noted, the entire venter seems to be white, but as this condition occurs also in one example from Rio de Janeiro, while several others from Rio are only slightly spotted or pale beneath, it does not appear to have any geographic significance.

The vomerine teeth are similar in position, although their degree of development differs individually. Most specimens have them very heavily developed, close together, triangular in shape, and lying between the posterior levels of the choanae and between their interior margins.

Remarks.—Very young specimens show the projecting upper jaw and the gray chin and chest dotted with pearly white. They differ considerably from four young *E. petropolitanus*, USNM 97437–40, from Paineiras, which have the chin and throat immaculate white and the snout rounded and not projecting. No immature examples of *E. miliaris* under 38 mm. long were found to have the black spines on the thumb, while *petropolitanus* has them well developed at 19 mm., and *E. lutzi* at 25 mm., at least.

This species is common in and near the city of Rio de Janeiro wherever outcropping, vegetation-covered rocks are moistened by springs. Some young ones were found under a mat of bromeliads on rocks along the Avenida Niemeyer, the drive facing the sea front to the west of the city. Others were found also within a few feet of the ocean at Recreio dos Bandeirantes on granite rocks covered with cactus and epiphytic plants. They are not averse to higher altitudes, however, because one was caught inside a deserted gold mining tunnel at Ouro Prêto in the mountains of Minas Gerais.

In the catalog of the museum of the University of Copenhagen, the type of *Cystignathus discolor* Reinhardt and Lutken had been identified as *Borborocoetes miliaris*, an identification I confirmed in 1951 when I examined the remaining Reinhardt and Lütken material.

In Vienna I examined Fitzinger's type of *Eupsophus fuliginosus*, from Rio de Janeiro taken by the Novara Expedition, 1857–1859; it appears to be a young *E. miliaris*.

MP 148, from Porto Cachoeiro, Espírito Santo, identified as *Ololigon abbreviatus petropolitana* by Miranda-Ribeiro, is very definitely not *Eupsophus petropolitanus*, and it is apparent that no true example of that species was known to Miranda-Ribeiro at the time of his writing. This specimen from Espírito Santo does not differ in any manner from the large series of *miliaris* now at hand from the neighboring State of Rio de Janeiro.

Miranda-Ribeiro erected the name *Ololigon abbreviatus taophora* for a form in which the color of the back is condensed in a T, its crossbars extending upon the upper eyelids and its staff generally being interrupted in a regular series of quadrate spots between nape and coccyx. Its lateral roughness is also supposedly more evident.

An example identified as *O. a. taophora* by Miranda-Ribeiro, MP 432, collected in 1906, has completely lost its color, but one from the same locality, USNM 96812, collected in 1922 still retains its pattern. It has the quadrate dorsal spots, the dark anterior bar between the eyes, and some very coarse tubercles along the sides. It is likewise entirely immaculate below, a condition not usually found in frogs from more northerly localities. But the quadrate spots and crossbars are matched identically in several specimens from Rio de Janeiro, while the heavy lateral tubercles are well developed in about half the specimens. A white throat and belly occur in one individual, USNM 96275, from Tijuca in the city of Rio de Janeiro, so that the last character which might possibly divide *taophora* as a geographic subspecies is broken down.

Specimens examined.

BRAZIL: ZSBS 2493/0 (type of *Rana miliaris*, "ad ripam Amazonum"), Spix; MHNP 46-326, Vellard.

BAHIA: Itaeté, MRHN IG 9308 Reg. 49 (type of *Hylodes brieni*), Massart, 1922.

DISTRICTO FEDERAL: Recreio dos Bandeirantes, USNM 97624–7, 97633–5, B. Lutz, Cochran, and Venancio, February 1935. Rio de Janeiro, AMNH 509; NHMW (type of *Eupsophus fuliginosus*), *Novara* Expedition; USNM 70588–90, Metcalf, Oct. 13, 1925. Avenida Niemeyer, USNM 97460–7, Cochran and Dias, Feb. 7, 1935. Mountains near Rio de Janeiro, ZSBS 66/1947 (6), A. Lutz, 1932. Paineiras, USNM 97428–36, B. Lutz and Cochran, Jan. 27, 1935. Rua Salvator Correio, USNM 97541–58, Dias, February-March 1935. Tijuca, USNM 96245, 97415–6, A. Lutz; MZUM 104268, 104269 (7), Bailey, 1941. Teresópolis, ZSBS 26 (2), Mar. 28, 1929; ZSBS 79/1942 (2), Bresslau, April 1914.

ESPÍRITO SANTO: MP 148. Mimosa, ZSBS 18/1947 (2), Bresslau.

MINAS GERAIS: Juiz de Fóra, UZMK (type of *Cystignathus discolor*). Ouro Prêto, USNM 97046, 97083, Cochran and Venancio, March 18, 1935.

RIO DE JANEIRO: Angra dos Reis, USNM 70588–90, Metcalf. Barreira, near Teresópolis, ZSBS 383, 2089, Bresslau, 1914. Guapi near Teresópolis, NMS, Giesler. Itatiaia, AMNH 17043–6, 17048–9, 17059, Holt. Mangaratiba, USNM 96390, Schirsch, January 1922. Nova Friburgo, USNM 97765, B. Lutz and Cochran, May 9, 1935. Petrópolis, USNM 38936, Barbour. Teresópolis, ZSBS 26 (2), Mar. 28, 1929; ZSBS 79/1942 (2), Bresslau, April 1914.

SÃO PAULO: Alto da Serra, USNM 96812, A. Lutz, February 1922; MP 432 (type of *Ololigon abbreviatus taophora*), Wackett, 1906. Boracea, DZSP 2349, 2352–4, 2359–60, 2363–4, 2369–70, 2373–4, 2380–8, 2390–2412, Bokermann, Jan. 12–18, 1948. Ilha de São Sebastião, MP 652.

Eupsophus petropolitanus (Wandolleck)

PLATE 26, FIGURES A–D

1907. *Hylodes petropolitanas* WANDOLLECK, p. 7, figs. D–F, pl. 1, figs. 9–9, f (type locality, Petrópolis, Rio de Janeiro).—NIEDEN, 1923, p. 461.—BAUMANN, 1912, p. 161.

1923. *Ololigon abbreviatus petropolitana* MIRANDA-RIBEIRO, 1923c, p. 844, pl. 1, fig. D.

1926. *Ololigon miliaris petropolitana* MIRANDA-RIBEIRO, pp. 61, 202.

1927. *Eleutherodactylus petropolitanus* L. MÜLLER, p. 275.

1947. *Thoropa petropolitana* B. LUTZ, p. 246.

Description.—Adult, USNM 97648, Independencia, Petrópolis, Rio de Janeiro. Vomerine teeth in two heavy, transverse, narrowly separated patches between the anterior choanal borders; maxillary teeth well developed; tongue about three-fourths as wide as mouth-opening, broadly cordiform, slightly indented on its free posterior border; a single small toothlike process in front of lower jaw; snout bluntly rounded when seen from above, truncate in profile, the upper jaw extending slightly beyond lower; nostrils more superior than lateral, scarcely projecting, halfway between eye and tip of snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded; loreal slightly concave and sloping to upper lip border. Eye large, prominent, its diameter equal to its distance from end of snout; interorbital diameter about 1⅕ times that of upper eyelid, equal to interval between nostrils. Tympanum distinct, one-half the diameter of eye, separated from eye by one-half its own diameter. Fingers long, webbed at base, without lateral ridges, fourth longer than second and reaching well toward base of penultimate phalanx of third; a low pad at base of first finger and another on palm; subarticular tubercles scarcely evident; toes free, their tips not dilated, with weak lateral ridges, third and fifth subequal, reaching halfway on antepenultimate phalanx of fourth; a large oval inner and a minute round outer metatarsal tubercle; no tarsal ridge; subarticular tubercles weak. Body fairly slender, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches considerably beyond tip of snout; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, knees overlap. Skin of upper parts smooth; glandular ridge from posterior corner of eye passing above tympanum and ending on the shoulder; venter smooth except for a few pustules around anus. No distinct ventral disk; in the male a few folds on each side of throat indicate the presence of a pair of external lateral vocal sacs.

Dimensions.—Head and body 21 mm.; head length 7.5 mm., width 7.5 mm.; femur 11 mm.; tibia 12 mm.; foot 11 mm.; hand 6.5 mm.

Color in alcohol.—Dorsum russet, with a few large, squarish, darker russet spots between shoulders and on sacrum; three dark cinnamon crossbars on upper leg surfaces, and two similar bars across forearm and wrist; sides paler; venter pale olive-buff with small russet spots scattered on throat and belly; a wide dark stripe along canthus, and a triangular dark spot below eye.

Variations.—As only a few adult specimens of *petropolitanus* are at hand, its true range of variation cannot yet be estimated. Four very young ones were taken on wet rocks at Independencia, Petrópolis. The one which still has a tail is 9 mm. in head and body length, with the limbs well developed, while two of the others, on which the tail is practically absorbed, are the same length. The smallest male, measuring 19 mm., already has 9–15 thumb spines; two males, each 21 mm. long, have 6–6 and 14–20 spines, while the single female, 25 mm. long, is without spiny patches on the thumb. The adpressed heel extends beyond the snout in two and to between the eye and tip of snout in the other two. The interorbital diameter equals the width of the upper eyelid in three; in one it is narrower.

Four young and many larvae from Paineiras are the same in detail as the four young ones found near an adult male of this species in Petrópolis.

Remarks.—This species is very distinct in some of its characters, although in general it is similar to *E. miliaris* and *E. lutzi.* Its chief points of difference from them are its more pointed snout, and its thumb patch of fairly large and regular spines, numbering between 6 and 20, which suggest those of the genus *Crossodactylus* in their size and arrangement. *Eupsophus miliaris* is much larger than the other two, adults up to 78 mm. being known, and it has usually two thumb patches of very minute spiny tubercles, and a single smaller patch on the second and often on the third fingers. Its snout is variable in shape but is usually flattened on the sides and bluntly rounded in front. *E. lutzi* is only a little larger than *petropolitanus;* in the small series at hand the largest one measures 28 mm., but like *miliaris* it has the minute spiny tubercles in two patches on the thumb and none on the second and third fingers. Its snout is almost a semicircle when seen from above, being conspicuously broader and blunter than either of the two allied species. All three occur together at Petrópolis.

Three cotypes, KZAEM D2037, measure 21, 20, and 22 mm. in head and body length. The first had no spines on its hands, the others 10–7 and 8–9 spines, respectively.

Specimens examined

BRAZIL:

- Districto Federal: Rio de Janeiro, ZSBS 33/1947, A. Lutz, 1923. Paineiras, Corcovado, USNM 97437–41, B. Lutz and Cochran, Jan. 27, 1935.
- Rio de Janeiro: Independencia, near Petrópolis, USNM 97648–9, B. Lutz, Cochran, and Venancio, May 5, 1935. Petrópolis, USNM 81135–6, A. Lutz, 1930; MZUM 68759, A. Lutz; KZAEM D2037 (3 adults, cotypes of *Hylodes petropolitanus*, and many tadpoles), Ohaus; ZSBS (5), A. Lutz, 1932. Teresópolis, USNM 96462, A. Lutz, Nov. 9, 1929.

Genus *Leptodactylus* Fitzinger

1826. *Leptodactylus* Fitzinger, p. 38. (Genotype, *Leptodactylus typhonia* Fitzinger=*Rana typhonia* (part) Daudin.)

Generic diagnosis.—Pupil horizontal. Tongue oval or rounded, entire or slightly nicked, and free behind. Vomerine teeth behind the choanae. Tympanum usually distinct. Fingers and toes free, not, or only slightly, dilated at the tips. Outer metatarsals united. Omosternum cartilaginous; sternum with a bony style. Terminal phalanges simple.

For a statistical analysis of measurements of the species of *Leptodactylus* here discussed, see pages 373 and 384

Key to the species of Leptodactylus of southeastern Brazil

a.^{1} Toes without distinct lateral ridges or fringes.

  b.^{1} Heel reaching posterior corner of eye.

    c.^{1} Foot very short (averaging 40 percent of total length); snout truncate; (size 53 mm.) . . . . **troglodytes** (p. 332)

    c.^{2} Foot longer (averaging 50 percent of total length); snout broadly rounded; (size 30 mm.) . . . . **marmoratus** (p. 306)

  b.^{2} Heel reaching between eye and nostril; snout obtusely pointed; (size 52.5 mm.) . . . . **sibilatrix** (p. 329)

a.^{2} Toes with lateral ridges sometimes widened to dermal fringes.

  b.^{1} Head longer than broad; snout pointed; heel reaching beyond snout; (size 46.5 mm.) . . . . **gracilis** (p. 304)

  b.^{2} Head as long as broad, or broader than long; snout rounded.

    c.^{1} Heel reaching between anterior corner of eye and nostril.

      d.^{1} Interorbital diameter ⅘ that of upper eyelid; (size 132 mm.). **ocellatus** (p. 315)

      d.^{2} Interorbital diameter not less than width of upper eyelid.

        e.^{1} Interorbital diameter 1½ times that of upper eyelid; (size 52 mm.) **mystaceus** (p. 310)

        e.^{2} Interorbital diameter equal to width of upper eyelid; (size 181 mm.) **pentadactylus labyrinthicus** (p. 323)

    c.^{2} Heel not reaching beyond anterior corner of eye.

      d.^{1} Heavy, enlarged glands on sides of body and femur; (size 137 mm.). **pentadactylus flavopictus** (p. 320)

      d.^{2} No especially large glands on sides of body or femur.

        e.^{1} Interorbital diameter twice the width of upper eyelid; (size 19 mm.). **gaigeae** (p. 302)

        e.^{2} Interorbital diameter not more than 1¼ times width of upper eyelid.

          f.^{1} First and second fingers subequal; interorbital diameter a little greater than upper eyelid; (size 46.5 mm.) **podicipinus** (p. 326)

          f.^{2} First finger longer than second; interorbital diameter 1¼ times the upper eyelid; (size 60 mm.) . . . . **mystacinus** (p. 313)

Leptodactylus gaigeae Cochran

Plate 26, Figures e–g

1938. *Leptodactylus gaigeae* Cochran, p. 41 (type locality, Bonito, Serra da Bocaina, Rio de Janeiro-São Paulo boundary).

Description.—Adult male, USNM 96759 (type), Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two heavy, transverse, well-separated patches behind the choanae and between their inner borders; maxillary teeth well developed; tongue one-half as wide as mouth-opening, oval, not indented on its free posterior border; a single, small toothlike process in front of lower jaw; snout nearly semicircular in outline when seen from above, slanting forward in profile, the upper jaw not extending beyond lower; nostrils superior, about halfway between eye and tip of snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis scarcely evident, the loreal region sloping broadly outward to the upper lip, so that the snout appears nearly flat. Eye moderate in size, its diameter two-thirds its distance from end of snout; interorbital diameter greater than distance between nostrils, twice the width of the weak upper eyelid, which is scarcely differentiated from the upper head region. Tympanum very indistinct, quite small, only the lower rim slightly projecting, its width about one-third the eye diameter, separated from eye by an interval equaling nearly twice its own diameter. Fingers free, apparently with very slight lateral ridges, their tips not dilated, first and second subequal, shorter than fourth, third quite long; subarticular and metacarpal tubercles moderate; no rudiment of a pollex; toes free, their tips not dilated, with distinct lateral ridges, third much longer than fifth and reaching to base of antepenultimate phalanx of fourth; a small oval inner and a minute round outer metatarsal tubercle; subarticular tubercles moderate; a weak tarsal ridge. Body moderately slender, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches only to front of shoulder; when limbs are laid along the body, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels just meet. Skin of upper parts smooth; a very distinct glandular lateral ridge from posterior corner of eye passing straight backwards at first and then bending on the sides and disappearing before reaching the groin; a very weak V-shaped glandular fold behind the head; a small round tubercle on the edge of the upper eyelid; ventral surface smooth (highly glandular under microscope) except under part of femur, which has some weak granules. No ventral disk; a few weak throat folds indicating a small external vocal sac.

Dimensions.—Head and body 19 mm.; head length 6 mm., width 6.5 mm.; femur 7 mm.; tibia 7 mm.; foot 8 mm.; hand 4 mm.

Color in alcohol.—Dorsal tone raw umber; a seal-brown stripe from eye to center of side bordering the glandular dorsolateral stripe below; a dark diagonal stripe in front of eye to border of upper lip, a pair of short dark stripes on the tip of the snout, and a few small dark spots along the edge of the upper lip; some small dark dots on the middorsal line just above the shoulder; no crossbars on upper surfaces of limbs, but a wide brown stripe on anterior surface of femur and several very dark brown spots on outer side of tibia; lower surfaces of femur and tibia dark brown with small light spots; center of belly pale drab, immaculate, its edges coarsely spotted; throat brown with minute light dots; hands and feet pale drab, lightening on toes and fingers.

Variations.—One other example from the same locality, USNM 96760, is very close to the described specimen except that its snout is less broadened when viewed from above. No trace of a tympanum can be made out in this individual. Its coloration is almost identical with that of the described specimen, except that the dark spots between the shoulders are scarcely apparent. The coarse pattern of large light spots on a dark ground is very evident on the sides and beneath the femur and tibia of both specimens, while the throat and chin are dark with very small white spots.

Remarks.—This species is quite suggestive of *Leptodactylus marmoratus* in regard to the general shape of head, position of vomerine teeth, and presence of a single median toothlike process in the lower jaw. The eyes are much less prominent than in *marmoratus*, however, and the nostrils are more superior. The femur is extremely short in *L. gaigeae*, causing the adpressed heel to reach only to the front of the shoulder, instead of to the eye, as in *marmoratus*. The latter has only a few dorsolateral glandules, faint when compared to the heavy gland of *gaigeae*, and the fingers are relatively longer, especially the first and second, which in *gaigeae* are weak in comparison. The pattern is as distinctive as the details of structure: The dorsum is almost immaculate in *gaigeae*, often heavily spotted in *marmoratus;* the brown stripe bordering the lateral gland below in *gaigeae* is much lower on the sides and much more clear-cut in outline than the rather irregular dark stripe which usually emphasizes the dorsolateral region in *marmoratus;* the dark white-spotted ground on the sides and lower surface of legs in *gaigeae* is only slightly suggested in *marmoratus* by irregular light spots on a clouded dark background incompletely covering the lateroventral region and the legs, while the throat region of the latter is pale with only a slight suffusion of gray dots on the sides towards the corner of the mouth.

This species also strongly suggests a *Zachaenus parvulus* at first glance. The sloping snout, the very short second finger, the short legs, the small eyes, and stout body are common to both. Direct comparison proves that they are not the same, however. *L. gaigeae* apparently is the link between *Zachaenus* and *Leptodactylus* in about the same degree as *Zachaenus* suggests *Ceratophrys* and *Craspedoglossa.*

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96759 (type) and 96760 (paratype), A. Lutz, Dec. 28, 1931.

***Leptodactylus gracilis* (Duméril and Bibron)**

Plate 27, Figures a, b

1841. *Cystignathus gracilis* Duméril and Bibron, p. 406 (type locality, Montevideo, Uruguay).—Bibron, 1847, p. 10, pl. 13, figs. 5–7,—Günther, 1858, p. 28.—Hensel, 1867, p. 130.—F. Müller, 1882, p. 130.

1875. *Leptodactylus gracilis* Espada, p. 44.—Boulenger, 1882a, p. 241; 1884b, p. 389; 1885a, p. 196; 1886a, p. 413; 1886b, p. 441.—Cope, 1887, p. 51.—Boettger, 1892, p. 30.—Berg, 1896, pp. 150, 183.—Baumann, 1912, p. 162.—Nieden, 1923, p. 483.—A. Lutz, 1924a, p. 235; 1926b, pp. 146, 165, pl. 32, figs. 4, 5, pl. 33, figs. 3, 6.—Peracca, 1895, p. 27.—Miranda-Ribeiro, 1926, p. 143; 1927, pp. 114, 116.—Bonjour, 1930, p. 385, figs. 1, 5, 8.—Müller and Hellmich, 1936, p. 39. fig. 14.

Description.—Adult female, USNM 96614, Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two heavy, transverse, nearly contiguous series between and behind the choanae; maxillary teeth present; tongue two-thirds as wide as mouth opening, heart-shaped, free posteriorly. Snout long, bluntly pointed at the tip when seen from above, in profile with a rim running backwards along upper lip to tympanum; upper jaw projecting far beyond lower. Nostrils superolateral, scarcely projecting, their distance from end of snout nearly as great as their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded but distinct, the loreal region flat, sloping to form an obtuse angle with the upper lip rim. Eye large and prominent, its diameter three-fourths its distance from tip of snout; interorbital diameter about 1¼ times the width of upper eyelid, equal to distance between nostrils. Tympanum large, distinct, about three-fourths the diameter of eye, separated from eye by an interval equal to one-third its own diameter. Fingers free, with very distinct lateral ridges, second and fourth subequal, reaching to base of penultimate phalanx of third; first very long, reaching to base of last phalanx of third; a small flat oval tubercle at base of thumb, and a much larger palmar tubercle; subarticular tubercles well developed. Toes with lateral ridges, not webbed, third a little longer than fifth, reaching to base of antepenultimate phalanx of fourth; a small conical inner and a minute wartlike outer metatarsal tubercle; an indistinct ridge along inner border of tarsus. Body rather slender, in postaxillary region equal to head width; when hind leg is adpressed, heel reaches considerably beyond tip of snout; when limbs are laid along the sides, knee and elbow overlap; when hind legs are laid at right angles to body, heels greatly overlap. Skin of upper parts very finely glandular; a pair of weak dorsolateral folds, and a much stronger lateral fold from posterior eye to groin, enlarging posteriorly and ending as an elongate gland in front of groin; a heavy gland behind the tympanum and below corner of mouth; venter smooth except for some weak granules on lower femur around anus; a distinct ventral disk. (A slitlike fold on each side of throat indicates a pair of internal vocal sacs in the male.)

Dimensions.—Head and body 45.5 mm.; head length 15 mm., width 14.5 mm.; femur 23.5 mm.; tibia 27.5 mm.; foot 30 mm.; hand 10.5 mm.

Color in alcohol.—Dorsum light gray; a white middorsal line and two lateral lines, the dorsolateral lines being less distinct; between these white lines are dark areas marked with black spots; a black stripe beginning at tip of snout, continuing along canthus and through eardrum to gland at corner of mouth, which is bordered below by a white line and along upper lip rim by a dark brown stripe; sides of body below white lateral line brown, the tubercles and glands white. Gland in front of groin white. Posterior femur with a white stripe bordered above and below by dark stripes, as in *mystaceus;* upper surfaces of legs with aggregations of black spots forming crossbars, the dark blotches on top of the femur being light centered; inside of tarsus and sole of foot dark brown; a short dark strip on anterior part of upper arm, and a dark stripe near elbow on posterior part; forearm with dark blotches. Venter pale buff, immaculate except for some brown spots at corner of mouth.

Variations.—In USNM 96731, also from Serra da Bocaina, the gland at the corner of the mouth is greatly developed, being as long as the snout, and looking like the flat parotoid found in some species of *Bufo*. The inguinal gland is sometimes less distinct than in the specimen described. Sometimes more longitudinal folds appear, especially around the lumbar region and along each side of the vertebral stripe, so that as many as five or six folds of varying lengths may be counted on each side in some frogs.

Remarks.—It is not easy to distinguish individual specimens of *Leptodactylus gracilis* from *L. sibilatrix.* The length of the leg is extremely variable in accepted specimens of *gracilis* and *sibilatrix,* so that the heel adpressed may reach beyond the snout or only to the nostril in the former, and to the tip of the snout or to the anterior border of the eye in the latter. In a series, however, the average length of the femur, tibia, and foot is greater in *gracilis*.

The relatively slender build of *gracilis* seems to be a fairly constant feature, and the snout itself is narrower in this species, although many individuals of *sibilatrix* have quite narrow snouts. Perhaps the most distinctive feature is the coloration of the posterior femur, which is mottled towards the upper surface, but below has a white longitudinal stripe bordered by more or less irregular black stripes extending for nearly the entire length of the femur in *sibilatrix*, while in *gracilis* the mottling is much more general, the white and black stripes being broken up, shorter, and sometimes scarcely evident at all. The dorsal dark spots are much larger in *sibilatrix* than in *gracilis*, and the median dorsal stripe, when present in *sibilatrix*, is wider.

More collecting in southern Brazil and in northern Uruguay may eventually produce series of frogs that will completely bridge the differences between these forms.

At Alto da Serra, São Paulo, *L. gracilis* was found in campos, or fields, in the valleys at the foot of the Serra, not on the peaks. The call is like that of a cricket, high and often repeated, *tit-tit-tit-tit-tit.* Eggs have not been observed in this region, but the tadpoles and young are frequently found in cow tracks, two or three perhaps in each one, or in other small holes in breijos (marshes). The species is too small to be eaten by the natives.

Specimens examined

BRAZIL:

- MINAS GERAIS: Ouro Prêto, USNM 98028–44, Cochran and Venancio, Mar. 19, 1935.
- RIO DE JANEIRO: Bonito, Serra da Bocaina, USNM 96614–6, 96728–36, A. Lutz. Serra da Bocaina, USNM 81133–4, A. Lutz, Jan. 19, 1930.
- RIO GRANDE DO SUL: Pôrto Alegre, KZAEM 2521, Emrich, 1933; ZMB 31094, Adloff. Santa Maria, IB 614–5.
- SANTA CATARINA: São Bento, ZSBS 100/1925, A. Lutz; USNM 97174–5, Behr, 1915.
- SÃO PAULO: Alto da Serra, USNM 96813–4, A. Lutz; MRHN IG 9308 Reg. 55, Massart, Oct. 1922. Capital, IB 178. Terceira Repressa, ZSBS (1), Schindler, Dec. 26–31, 1937.

URUGUAY: Montevideo, MHNP 189, d'Orbigny.

***Leptodactylus marmoratus* (Steindachner)**

PLATE 27, FIGURES C–F

1867. *Adenomera marmorata* STEINDACHNER, p. 37, pl. 3, figs. 5–8 (type locality, Brazil).

1885. *Leptodactylus diptyx* BOETTGER, p. 244 (type locality, Paraguay).—BOULENGER, 1886a, p. 413.—NIEDEN, 1923, p. 484.—MIRANDA-RIBEIRO, 1926, p. 148.—A. LUTZ, 1930, pp. 10, 29.—PARKER, 1931, p. 286.—MELLO-LEITÃO, 1937, p. 315.

1895. *Leptodactylus diptix* PERACCA, p. 28.

1922. *Leptodactylus nanus* L. Müller, p. 168, figs. 4–6 (type locality, Rio Novo, Santa Catarina).—Barbour and Loveridge, 1929, p. 293.—A. Lutz, 1924a, p. 235; 1926b, pp. 150, 169, pl. 32, figs. 10, 11; 1930, pp. 11, 30.—Myers, 1946, pp. 10, 28.—B. Lutz, 1947, pp. 247–8; 1949a, pp. 3–4.

1926. *Leptodactylus trivittatus*, A. Lutz, 1926a, pp 3, 10 (type localities, Serra de Cubatão and Campo Bello, São Paulo); 1926b, pp. 151, 170, pl. 32, figs. 14, 15.—B. Lutz, 1947, p. 248.

1932. *Leptodactylus marmorata* Parker, p. 342.

1933. *Leptodactylus hylaedactylus* (not of Cope) Ahl, p. 25.

1935. *Leptodactylus marmoratus* Parker, p. 507; 1939, p. 87.

Description.—Adult female, USNM 96942 (cotype of *Leptodactylus trivittatus*), Montserrat, Campo Bello, Rio de Janeiro. Vomerine teeth in two long, very heavy, transverse, narrowly separated rows far behind the choanae; tongue a little more than half as wide as mouth-opening, oval, not indented on its free posterior margin; snout blunt, short and broadly rounded when seen from above, truncate and sloping slightly forwards to the lip border in profile, the upper jaw consequently not projecting beyond the lower; nostrils more lateral than superior, projecting, their distance from end of snout less than one-half that to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis very blunt, the loreal region slightly concave and slanting outwards considerably towards the upper lip border. Eye large and prominent, its diameter only slightly greater than its distance from nostril; interorbital diameter 1⅔ times the width of the rather narrow upper eyelid, about equal to distance between nostrils. Tympanum small but distinct, one-half the width of eye, separated from eye by an interval nearly as great as its own diameter. Fingers free, not fringed, their tips scarcely dilated, not grooved above, second and fourth subequal, reaching slightly beyond the base of penultimate phalanx of third; no pronounced pollex, but subarticular and palmar tubercles well developed; toes without webs or fringes, all their disks except the first one distinctly larger than those of the fingers, not grooved above and with the terminal bones decidedly T-shaped; third toe much longer than fifth, reaching well beyond the base of antepenultimate phalanx of fourth; a prominent blunt-edged inner and a small wartlike outer metatarsal tubercle; a distinct inner tarsal ridge emanating from base of inner tubercle and extending nearly to heel; body moderately slender, in postaxillary region slightly less than greatest width of head; when hind leg is adpressed, heel reaches to posterior corner of eye; when limbs are laid along the sides, knee and elbow barely touch; when hind legs are bent at right angles to body, heels considerably overlap. Skin of upper parts thick and smooth, appearing minutely glandular under microscope; no prominent supratympanic ridge; a pair of prominent oval glands on each side of the anus; ventral surface smooth except the lower and posterior surfaces of thighs which are slightly granular. A slight skinfold across the chest between the axillae. (No external vocal sac in the male, but a prominent ridge on the tip of the snout.)

Dimensions.—Head and body 25 mm.; head length 8.5 mm., width 9 mm.; femur 10 mm.; tibia 11 mm.; foot 10.5 mm.; hand 5.5 mm.

Color in alcohol.—Dorsum faded to pale buff; a trace of sepia on the canthus rostralis, and a narrow sepia line leaving the posterior corner of the eye, passing above the tympanum, and breaking up on the sides into a series of dots which continue to the groin; above this a broad immaculate light stripe, of which the upper border is again dotted with sepia vermiculations, fainter anteriorly; lateral anal region with some sepia markings, and traces of crossbars on upper surface of forearms, femur, and tibia, stronger on the last; posterior femur faintly reticulated with sepia; ventral surface immaculate pale buff.

Color in life.—Based on USNM 96943, immature cotype (in Lutz, 1926b, pl. 32, figs. 14, 15). Ground color of back and head clove brown, lighter on canthus and tip of snout; a clove-brown lateral stripe from tympanum halfway to groin, above it a wide, dorsolateral, orange-vermilion, lateral stripe from eye to groin, and another narrower middorsal one of the same color beginning between the shoulders and widening in front of the anus; upper arm, elbow, and heel orange vermilion; upper surface of femur and tibia dull sage green with dark crossbars, feet and hands paler but similarly barred.

Variations.—In six topotypes from the same series as the described specimen, a fair degree of uniformity is observed in most characters. The snout is uniformly blunt and rounded when seen from above, the difference in sex seeming to affect its length very slightly, although in profile the males show a distinct transverse ridge that is highly modified or lacking in females. The interorbital diameter is from 1⅓ to 2 times the width of the upper eyelid, while the nostril may be midway between eye and tip of snout, or considerably nearer to the latter. Head width and length (from posterior border of tympanum) are usually equal, although the width is a trifle greater than the length in the described cotype. The skin is usually very smooth; in only one of the topotypes is there a faint suggestion of a dorsolateral glandular line.

Practically the same variations are met with in specimens from the States of São Paulo and Rio de Janeiro. Wherever the color pattern still shows, every intergrade can be found from the strongly striped form figured as typical *L. trivittatus* by Dr. Lutz to a spotted form without a trace of dorsolateral stripes (except perhaps for a dark line over the ear), resembling the pattern figured by Müller for *L. nanus* (see Lutz, 1926b, pl. 32, figs, 10, 11).

Remarks.—This confusing species has been described under several different names and perhaps further study may add others, as Parker (1935, p. 508) has already suggested. It is one of the species that tends to bridge the gap between *Leptodactylus* and *Eleutherodactylus*, for the terminal phalanges of the toes are distinctly T-shaped, while the terminal disks show a corresponding enlargement, unlike most of the other species in the genus *Leptodactylus*.

The pattern is more variable than is usual in the other leptodactyli of Brazil, some examples having three pale red stripes on the back, a fact that led Dr. Lutz to consider them as a species distinct from *L. marmoratus* (=*nanus* Müller). Since this variation has been found in practically every locality from which *marmoratus* itself is known, as well as intergrading patterns with the stripes greatly reduced, it seems proper to add the name *trivittatus* to the synonymy of *marmoratus*.

It is quite apparent that *L. marmoratus* is the southern representation of *L. hylaedactylus*. These little frogs are so similar in size, color, and general bodily proportions that they might easily be confused were it not for certain fixed differences that separate them. *L. hylaedactylus* is much more rugose dorsally than its southern ally; it has dorsolateral glands which often appear as true folds; there are many short glands on the center of the back as well as on the sides; and the head is altogether more pointed than that of *marmoratus*. Viewed from above this is not so apparent, but from below the chin the outline is oval-pointed in the former, nearly semicircular in the latter. Thus, *marmoratus* appears to have a wider head and a shorter snout than *hylaedactylus*. The interorbital width seems slightly greater in *marmoratus*, and the eyelids are usually much narrower and the eyes less projecting, although sometimes, as in USNM 97475, the width of the lids approaches that of *hylaedactylus*. Color patterns in both species are extremely similar. Sometimes an example of *hylaedactylus*, as in AMNH 44782, will have a light dorsolateral stripe (as in some of the *marmoratus* specimens called *trivittatus* by Dr. Lutz for the same reason). The body in *hylaedactylus* seems longer in proportion to its total length, perhaps because of its pointed head, but the proportions of hand and foot are almost identical in the two species. The upper tibial and femoral surfaces of *hylaedactylus* are rough and tubercular, while those of *marmoratus* are practically smooth.

I saw a nest of *L. marmoratus* on February 7, 1935, buried over a foot deep in a clay bank about 10 feet above a shallow pool near Covanca, Jacarépaguá. The eggs were discovered by the collector

Venancio as he sliced with a machete into the soft red clay near which several adults had been caught hopping about in the fallen leaves. Although some larvae may have been destroyed, four eggs were taken out with the clay mass. When found they were on the point of hatching, as the larvae could wriggle in their soft masses of foam. No egg capsules were to be seen. The eggs were not closely in contact, but this may have been due to the breaking up of the nest with the machete. The larvae were photographed as they hatched. The metamorphosis was rapid; in three days the limbs developed, although a long tail still remained. At this stage the head and body length was 4 mm.; the tail 9 mm. Not more than four eggs have been found in any one female, the largest measuring up to 3 mm., and it is probable that not very many more than that are produced.

Specimens examined

BRAZIL: NHMW (1; type of *Adenomera marmorata*).

Districto Federal: Cosme Velho, USNM 119000–03, Venancio, November 1940. Covanca, Jacarépaguá, USNM 97471–85, Cochran, Dias, and Venancio, Feb. 7, 1935. Rio de Janeiro, Rio Comprido, USNM 97235, A. Lutz. Tijuca, USNM 81132, 96300–2, MZUM 68792, A. Lutz; MZUM 104249, 104275 (5), 104278 (5), Bailey, 1941.

Minas Gerais: Agua Limpa, Ouro Prêto, USNM 96997, A. Lutz, Oct. 22, 1923.

Rio de Janeiro: Angra dos Reis, USNM 70591–2, 96519. Barro Branco, MZUM 104263–4, Bailey, 1941. Guapi, Teresópolis, USNM 97681–90, Sandig, 1935. Montserrat, Campo Bello, USNM 96936, 96938–43, A. Lutz. Niterói, ZSBS 34/1947, A. Lutz, 1923. Sacco São Francisco, USNM 99122, Venancio, Feb. 7, 1935. Petrópolis, USNM 96417, 96430, A. Lutz. Teresópolis, ZSBS 285, Bresslau, February–March 1929; ZSBS (3), Bresslau, Mar. 22, 1929.

Santa Catarina: Colonia Hansa, near Itapocú, ZSBS 661/20, Erhardt. Humboldt, ZSBS 659/1920 (type of *L. nanus*), Erhardt; ZSBS 66/1920 (4; paratypes of *L. nanus*), Erhardt. Joinville, NMS (2). Ouro Verde, ZSBS (1), Löffler, Nov. 15, 1927. Rio Humboldt, MZUM 58509; USNM 66583, 118177–8. Rio Novo, NHMB 2767 (10), 3133 (5), Erhardt, 1916–9.

São Paulo: Alto da Serra, USNM 96815–9 (cotypes of *L. trivittatus*), A. Lutz, 1922–4; USNM 97858, Cochran and Venancio, Apr. 25–26, 1935. Boracea, DZSP 2729–32, Bokermann, January 1948. Ibití, DZSP 2336, Lima, 1946. Rio Paranaíba, bridge 21 mi. above Araguari, CM 2688, Haseman, Aug. 15, 1908.

Leptodactylus mystaceus (Spix)

Plate 27, Figures g, h

1824. *Rana mystacea* Spix, p. 27, pl. 3, figs. 1, 3 (type locality, Bahia, Solimoẽs).

1904. *Leptodactylus mystaceus* Méhely, p. 219, pl. 13, fig. 12.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 487.—A. Lutz, 1924a, p. 235; 1926b, pp. 147, 166, pl. 32, figs. 6, 7; 1930, pp. 10, 30.—Miranda-Ribeiro, 1926, p. 141.—Parker, 1928, p. 99; 1935, p. 509.—Crawford, 1931, p. 30.—Crawford and Jones, 1933, p. 89.—Mello-Leitão, 1937, p. 268.—Carvalho, 1939a, p. 280.—Myers, 1946, pp. 10, 28.—B. Lutz, 1947, pp. 247–248; 1949a, p. 4.

?1912. *Leptodactylus longrostris* (not of Boulenger) BAUMANN, p. 93 (specimens from the Organ Mountains, Rio de Janeiro).—NIEDEN, 1923, p. 488 (part).

Description.—Adult male, USNM 99120, Sacco São Francisco, Niterói, Rio de Janeiro. Vomerine teeth in two strong, narrowly separated patches behind and between the choanae; tongue one-half as wide as mouth-opening, almost rectangular, with a slight indentation on its free posterior border. Snout moderately long, rounded when seen from above; viewed in profile, snout shows a decided ridge between nostril and edge of mouth extending back as far as the nostrils; upper jaw projecting beyond lower. Nostrils superolateral, not projecting, their distance from end of snout about one-half their distance from eye, separated from each other by an interval equal to that from nostril to eye. Canthus rostralis rounded but well-marked; the loreal region concave, sloping gently to the flaring upper lip. Eye large and prominent, its diameter nearly equal to its distance from end of snout; interorbital diameter 1½ times the width of upper eyelid, equal to distance between nostrils; tympanum large, distinct, two-thirds the width of eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, with faint lateral ridges, second and fourth subequal, reaching to base of penultimate phalanx of third, first very long, reaching to base of last phalanx of third; a large projecting oval tubercle at base of thumb and a larger rounded palmar tubercle; the subarticular tubercles well developed. Toes with lateral ridges, not webbed, third a little longer than fifth, reaching midway along antepenultimate phalanx of fourth; a small, conical inner and a minute rounded outer metatarsal tubercle; a faint glandular ridge on inside of tarsus reaching almost to heel. Body moderately stout, in postaxillary region a little narrower than greatest head width; when hind leg is adpressed, heel reaches between eye and nostril; when limbs are laid along the sides, knee and elbow overlap; when hind legs are placed at right angles to body, heels greatly overlap. Skin of upper parts faintly glandular; a pronounced dorsolateral glandular fold with a shorter, less distinct one below it on each side; a short glandular ridge above tympanum; posterior part of back and upper tibia with minute raised pustules; venter smooth except for some weak granules below anus; a distinct ventral disk. A heavy elongate gland beginning behind angle of mouth, ending above shoulder; a diagonal slitlike depression on each side of the neck just below angles of mouth show the presence of internal lateral vocal sacs.

Dimensions.—Head and body 40 mm.; head length 14.5 mm., width 14.5 mm.; femur 18 mm.; tibia 21.5 mm.; foot 21 mm.; hand 9.5 mm.

Color in alcohol.—Dorsum sepia, with an indistinct darker triangle between the eyes, and irregular dark patches across the back; a distinct wide white line on posterior femur bordered above and below by dark brown lines, the upper part of femur, tibia, and foot with four or five dark brown crossbars; a wide black stripe from tip of snout through loreal region and across ear to shoulder, the lip below light-bordered, this light stripe ending as a white spot in front of shoulder; a short dark line from angle of lower jaw beneath this white spot; a short black stripe on anterior part of upper arm, and a similar one below forearm. Venter buff, immaculate except for a few small dark spots around edge of mouth and on lower tibia and foot. Soles of feet dark brown.

Variations.—In spite of its extensive range, the variation in critical body measurements is well within the range found in a single species. The adpressed heel may reach the posterior corner of the eye, or as far as the nostril. The snout is sometimes very bluntly rounded, at other times somewhat more acuminate. A single pair of dorsolateral folds occurs in all specimens, but below these may be one or several short lateral folds, usually marked towards the groin by a row of glandular tubercles. The gland at the angle of the mouth is better developed in some frogs than in others, often projecting appreciably outwards behind the tympanum. Its distinctive color, dark brown above and white below, makes it easy to observe in most preserved material. The mottling of the back may be coarse, fine, or scarcely apparent, or it may take the form of short longitudinal stripes. The white, dark-bordered stripe on the posterior femur is always present.

Remarks.—This species is localized and not very common. Its voice is a whistle often repeated, in pitch somewhat like that of a whip-poor-will. The eggs are laid in holes in the ground from September to November and many tadpoles emerge when the rain comes,.

Cope's type of *Cystignathus poecilochilus*, USNM 4347, from near Turbo, Colombia, though soft and flabby, is still well enough preserved to allow of careful comparison with Brazilian examples of *Leptodactylus mystaceus*. The chief difference seems to be that the type of *poecilochilus* has a bluntly rounded snout, instead of the pointed, transversely ridged snout of most Brazilian *mystaceus*, yet an occasional one from Brazil has a rounded blunt snout, so that this character must be considered unstable. The interorbital width in the type is actually a little less than the width of the upper eyelid, and not equal to it, as reported by Boulenger (1882a, p. 243), but in all the Brazilian specimens at hand, as well as one from Panamá (close to the type locality), the interorbital diameter is less than the width of the prominent upper eyelid. Dr. Dunn writes me, under date of Sept. 24, 1949, that he believes *poecilochilus* from Panamá to be very close to *mystaceus* but that he considers the Andes a barrier to their true specific identity.

A flat ovoid or kidney-shaped gland considerably larger than the eye occurs on the shoulder just behind the tympanum. It is still prominent in the type of *poecilochilus* and very distinct in the best-preserved specimens of *mystaceus* from Brazil. Both Cope and Boulenger failed to mention this structure.

Specimens examined

BRAZIL:
- Bahia: ZSBS 2505/0 (type of *Rana mystacea*), Spix.
- Districto Federal: Swamp 40 km. on road to São Paulo, USNM 97572–3, A. Lutz, Cochran, and Venancio, Feb. 10, 1935.
- Espírito Santo: Itá, IB 129–30, 139, 143–5, 172–3, 205–7, 238–9.
- Minas Gerais: Agua Limpa, USNM 96995–6, A. Lutz, December 1922. Januária, IB 414–6. Rio Pandeiro, IB 477–8, 487, 499, 537–8.
- Rio de Janeiro: Guapi, Teresópolis, NMS, Sandig. Merity, USNM 96222, A. Lutz, Oct. 6, 1923. Niterói, USNM 96400–2, A. Lutz, Aug. 10, 1923. Sacco São Francisco, Niterói, USNM 96407–11, 99120, A. Lutz, Oct. 13, 1923. Serra do Friburgo, USNM 98467, Venancio, December 1923.
- Rio Grande do Sul: Canella, ZSBS (1), Gliesch, 1929.
- Santa Catarina: Humboldt, ZSBS 70/25 Erhardt. São Bento, USNM 97176–8, Behr, 1915.
- São Paulo: Jurú Mirim, IB 237.

URUGUAY: Montevideo, MRNH IG 4544 Reg. 392.

***Leptodactylus mystacinus* (Burmeister)**

Plate 27, Figures i, j

1858. *Cystignathus schomburgkii* (not of Troschel) Günther, p. 29.
1861. *Cystignathus mystacinus* Burmeister, p. 532 (type locality, Rosario [Argentina]).—Weyenbergh, 1876, p. 165.—F. Müller, 1882, p. 130.
1867. *Cystignathus mystaceus* (not of Spix) Hensel, p. 125.
1875. *Leptodactylus wuchereri* Espada, p. 68 (type locality, Argentina).
1882. *Leptodactylus mystacinus* Boulenger, 1882a, p. 244; 1885a, p. 196; 1886b, p. 441.—Boettger, 1885, p. 244; 1892, p. 30.—Cope, 1885a, p. 187.—Berg, 1896, pp. 150, 186.—Peracca, 1897, p. 17.—Gadow, 1901, p. 219.—Brandes and Schoenichen, 1901, p. 403.—Méhely, 1904, p. 217, pl. 13, fig. 11.—Baumann, 1912, p. 162; 1917, p. 141.—Nieden, 1923, p. 485.—Marelli, 1924, p. 586.—A. Lutz, 1924a, p. 235; 1926b, pp. 148, 167, pl. 32, figs. 8, 9; 1927, pp. 39, 45; 1930, pp. 10, 30 [misprinted "*mystaceus*" on p. 30].—Beebe, 1925, p. 124.—Miranda-Ribeiro, 1927, p. 114.—Crawford, 1931, p. 30.—Eisentraut, 1932, p. 325.—Crawford and Jones, 1933, p. 89.

Description.—Adult male, USNM 99121, Sacco São Francisco, Niterói, Rio de Janeiro. Vomerine teeth in two heavy, narrowly separated, transverse patches behind and between the choanae; maxillary teeth present; tongue large, two-thirds as wide as mouth-opening, notched on its free posterior border; snout moderately long, bluntly rounded when seen from above; viewed in profile, snout shows a decided ridge between nostril and edge of mouth extending backwards to tympanum; upper jaw projecting beyond lower. Nostrils superolateral, slightly projecting, their distance from end of snout about four-fifths their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded; loreal region sloping considerably, forming a concavity before meeting rim bordering upper lip. Eye large, prominent, its diameter two-thirds its distance from end of snout; interorbital diameter about 1½ times the width of upper eyelid, equal to distance between nostrils. Tympanum large, distinct, one-half the width of eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, with faint lateral ridges, second and fourth subequal, reaching to base of antepenultimate phalanx of third, first longer, reaching nearly to base of last phalanx of third; a large projecting oval tubercle at base of thumb and a somewhat larger heart-shaped one on the palm; the other subarticular tubercles well developed. Toes with lateral ridges, third longer than fifth, reaching midway along antepenultimate phalanx of fourth; a small sharp conical inner and a minute rounded outer metatarsal tubercle; a glandular line along inside of tarsus scarcely becoming a ridge. Body quite stout, in postaxillary region narrower than the head width; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the body, knee and elbow touch; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts finely glandular, thickening to a pair of broad, indistinct dorsolateral folds; a very pronounced lateral fold from above arm to groin, the skin on the sides and on the legs with many pustules and small tubercles; a curved glandular ridge above and behind tympanum, ending in a wide, heavy gland at corner of mouth and almost meeting the upper lip ridge below the tympanum; venter smooth except for some weak granules on lower femur and around anus; a distinct ventral disk. Lateral folds on either side of throat indicating internal vocal sacs.

Dimensions.—Head and body 50.5 mm.; head length 18 mm., width 18 mm.; femur 20 mm.; tibia 22 mm.; foot 20.5 mm.; hand 12 mm.

Color in alcohol.—Dorsum drab gray, with coarse black spots more or less grouped in pairs down center of back; a black stripe along dorsolateral folds; a wide brown stripe beginning at tip of snout, covering the loreal region and continuing across tympanum to shoulder bordered below by a white stripe along the upper lip ridge, which in turn is bordered below by another dark stripe extending beneath gland at corner of mouth; arms and legs with black crossbars; posterior femur with large irregular marblings of dark brown, but without a distinct light dark-bordered stripe on posterior femur as in *L. mystaceus*. Upper arm with a wide dark stripe on its anterior and posterior surface. Soles of feet dark brown. Sides mottled with light and dark spots. Venter light clay color, immaculate except for dark suffusions on the throat of the male.

Remarks.—This species is not difficult to recognize, as it is much heavier in build than its closest ally, *L. mystaceus*, and lacks the light, dark-bordered stripe on the posterior femur.

The fourth toe of *L. mystacinus* is relatively much shorter, and the whole hind limb much stouter and heavier than in *L. mystaceus* The snout of the former is also more rounded, while the head is broader posteriorly. Glandular dorsolateral folds are weakly developed in *mystacinus;* in the specimens at hand the skin of that region appears only more porous and thicker than that surrounding it, instead of appearing as the narrow sharp folds characterizing *mystaceus.* The dorsal color pattern expressed in Méhely's (1904) figure consists of wide longitudinal black dorsolateral stripes, quite different from the more spotted, dull-colored *mystaceus.* As noted, the posterior femur of *mystaceus* has a distinct light line edged above and below with dark in all the specimens at hand, while Méhely's figure of *mystacinus* as well as all specimens I have examined have the posterior femur dark with light irregular spots not arranged in a line. But *mystaceus* and *mystasinus* belong obviously in the same subdivision of the genus, since both have a discoidal abdominal fold, a sharp edge around the snout, and a pronounced gland behind the tympanum.

The frog described was taken in a grass-covered spot near a marsh where eggs of *Hyla decipiens* were found. In the same field were several adults and young of *mystaceus,* which occupy the same habitat as *mystacinus.*

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro, ZSBS (5), A. Lutz, 1923.

Minas Gerais: Lagôa Santa, UZMK 165–7, Warming.

Rio de Janeiro: Niterói, ZSBS (1), 99/25, A. Lutz, 1923. Sacco São Francisco, Niterói, USNM 99121, Venancio, Feb. 14, 1935. Teresópolis, ZSBS, Bresslau, Mar. 22, 1929.

Rio Grande do Sul: Estrella, ZSBS 16, 58, 59, Gliesch, 1929. Pôrto Alegre, ZSBS 1067/0. Rio Grande do Sul, UZMK 174, von Ihering. Santa Maria, IB 613.

Santa Catarina: Humboldt, ZMB 29482, Erhardt, ZSBS 70/1925 (6), Erhardt, November 1919.

São Paulo: Butantan, IB 594–5. Capital, IB 177. Cerqueira César, IB 606.

***Leptodactylus ocellatus* (Linnaeus)**

Plate 28, Figures a–d

1758. *Rana ocellata* Linnaeus, p. 211 (type locality, America).

1815. *Rana latrans* Steffen, p. 8, figs. 1–4.

1824. *Rana pachypus* Spix (part), p. 26, pl. 2, fig. 2, pl. 3, fig. 1 (specimens from Rio de Janeiro and Bahia).—Wied, 1825, p. 540.

1824. *Rana pygmaea* Spix, p. 30, pl. 6, fig. 2 (type locality, Bahia).
1830. *Cystignathus pachypus* Wagler, 1830a, p. 203; 1830b, pl. 21, figs. 1, 2 (part synonymy).—Peters, 1873a, p. 206.
1841. *Cystignathus ocellatus* Duméril and Bibron (part), p. 396.—Guichenot, 1855, p. 78.—Günther, 1858, p. 27.—Reinhardt and Lütken, 1862, p. 163.—Hensel, 1867, p. 123.—Steindachner, 1867, p. 22.—Cunningham, 1871b, p. 467.—Peters, 1872b, p. 768; 1873a, p. 199.—Boettger, 1881, p. 132.—F. Müller, 1882, p. 130.
1853. *Leptodactylus ocellatus* Girard, p. 420; 1858, p. 20, pl. 3, figs. 1-6.—Hensel, 1867, p. 125.—F. Müller, 1884, p. 281.—Boulenger, 1882a, p. 247; 1885a, p. 196; 1886b, p. 442; 1889, p. 247; 1894, p. 348; 1898a, p. 126; 1902a, p. 337.—Boettger, 1885, p. 244; 1893, p. 40.—Cope, 1885a, p. 187; 1890, p. 143.—Werner, 1894a, p. 413; 1894b, p. 125.—Koslowsky, 1896, p. 152.—Peracca, 1895, p. 28; 1897, p. 17; 1904a, p. 12.—Berg, 1896, pp. 150, 179.—Budgett, 1899, pp. 305-306.—Gadow, 1901, p. 219.—Brandes and Schoenichen, 1901, p. 403.—Stejneger, 1901, p. 180.—Méhely, 1904, p. 223.—Andersson, 1906, p. 9.—Baumann, 1912, p. 95; 1917, pp. 132, 140.—Nágera, 1915, p. 24.—Beebe, 1919, p. 209.—L. Müller, 1922, p. 170.—Nieden, 1923, p. 490.—Marelli, 1924, p. 586; 1931, p. 200.—A. Lutz, 1924a, p. 235; 1926b, pp. 144, 164, pl. 31, figs. 3, 4, pl. 33, fig. 7, pl. 35, figs. 3, 4; 1930, pp. 11, 30.—Mertens, 1926b, p. 4; 1928, p. 295.—Brazil and Vellard, 1926, p. 21.—Miranda-Ribeiro, 1926, p. 146, fig. 78; 1927, pp. 114, 128; 1937a, p, 56.—Luederwaldt, 1929, p. 39.—deWitte, 1930a, p. 225.—Bonjour, 1929, p. 385, figs. 3, 4.—Vellard and Vianna, 1931, p. 11.—Parker, 1935, p. 508; 1939, p. 87; 1940, p. 203.—Serie, 1935a, p. 493.—Müller and Hellmich, 1936, p. 41, fig. 15.—Carvalho, 1937, p. 12.—Mello-Leitão, 1937, p. 329.—Schubart, 1939, p. 54.—Travassos and Freitas, 1942, p. 283.—Travassos, 1944, p. 127.—Myers, 1946, pp. 10, 28.—Cei, 1948, pp. 283-331, pls.—Cei and Caruso, 1948, pp. 277-8, pls. 1, 2.
1853. *Leptodactylus serialis* Girard, p. 421 (type locality, Rio de Janeiro).
1853. *Leptodactylus caliginosus* Girard, p. 422 (type locality, Rio de Janeiro), 1858, p. 31.—A. Lutz, 1930, p. 22 (references to type of *caliginosus* only).—Miranda-Ribeiro, 1926, pp. 149, 219.—Schubart, 1939, p. 53.—Travassos and Freitas, 1942, p. 283.
1861. *Cystignathus caliginosus* Burmeister, p. 532.
1875. *Leptodactylus pachypus* Espada, p. 48.
?1875. *Leptodactylus latinasus* Espada, p. 40 (type locality, Montevideo).
1892. *Rana luctator* Hudson, p. 78, fig.
1892. *Leptognathus* (sic) *ocellatus* Boettger, p. 31.
1926. *Leptodactylus occelatus* (sic) Brazil and Vellard, p. 43.—L. Müller, 1927, p. 281.
1926. *Leptodactylus o*[*cellatus*] *macrosternum* Miranda-Ribeiro, p. 147, fig. 79 (type locality, Bahia); 1927, p. 125.—A. Lutz, 1930, pp. 12, 31.

Description.—Adult male, USNM 98261, Pirapora, Minas Gerais. Vomerine teeth in two heavy, transverse, nearly contiguous patches behind and between the choanae; tongue three-fourths as wide as mouth-opening, cordiform, with a slight indentation on its free posterior border; snout long, rounded when viewed from above, slightly truncate in profile; no pronounced labial ridge; upper jaw projecting considerably beyond lower. Nostrils superolateral, not projecting, their distance from end of snout slightly less than their distance from eye, separated from each other by an interval equal to their distance from tip of snout. Canthus rostralis distinct; the loreal region sloping very gradually, concave, merging with the flaring upper lip. Eye large, prominent, its diameter equal to three-fourths its distance from end of snout; interorbital diameter about four-fifths the width of upper eyelid, a little less than distance between nostrils. Tympanum large, distinct, three-fourths the diameter of eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, with distinct lateral ridges, fourth finger longer than second, reaching to base of antepenultimate phalanx of second, first longer than fourth, reaching almost to base of last phalanx of third; two heavy tubercles on thumb, one at base and one halfway to tip of first finger, each equipped with a black spur in the breeding season; subarticular and palmar tubercles well developed. Toes webbed at the base, with distinct lateral ridges, third longer than fifth, reaching halfway on antepenultimate phalanx of fourth; a small conical inner and a minute flattened outer metatarsal tubercle; a heavy glandular ridge on tarsus from inner tubercle to heel. Body stout, in postaxillary region nearly equal to the head width; when hind leg is adpressed, heel reaches to anterior eye; when limbs are laid along the sides, knee and elbow slightly overlap; when hind legs are bent at right angles to body, heels considerably overlap. Skin of head smooth, back with five pairs of longitudinal folds, the outer pair emanating from the eye, margining the upper tympanum and continuing to the groin; the next pair dorsolateral in position, less distinct anteriorly and ending in a series of short glands behind the sacrum; the next two pairs edging the light stripe which leaves the upper eyelid and continues down the back to the base of the legs; the inmost pair short, not distinct anteriorly or posteriorly, lying on each side of the vertebral lines; some scattered, short conical glands on sides, occiput and top of femur; no definite gland in groin or behind commissure of mouth; posterior surface of femur with granules and many small ridged glands which extend across the lower part of femur; a distinct ventral disk; a fold on each side of neck in front of shoulder indicates the presence of internal vocal sacs.

Dimensions.—Head and body 76 mm.; head length 26 mm., width 26 mm.; femur 32 mm.; tibia 36 mm.; foot 38 mm.; hand 17 mm.

Color in alcohol.—Dorsum slate-gray, with a large heart-shaped black spot between the eyes and extending backwards almost to base of occiput; a wide black band commencing at end of snout, covering the canthus and ending on anterior eyelid; behind the eye a series of irregular dark blotches extends down the sides, bordered above by the wide light dorsolateral stripes; between these stripes are irregular transverse dark blotches, especially prominent above the anus where the light stripes have faded out; upper lid with three dark triangular blotches bordered by light lines; edge of lower jaw dark, with a single row of large round light spots; venter otherwise pale olive-buff, a little darker posteriorly; legs with heavy dark crossbars above, continued on top of feet; posterior femur slate-gray, with small darker marblings. Sides of body irregularly spotted above, becoming paler below.

Remarks.—To the synonymy of *Leptodactylus ocellatus* it is necessary to add Girard's (1853) *L. caliginosus*. The two cotypes, USNM 7389, from Rio de Janeiro collected by the U. S. Exploring Expedition, are still in good condition, considering their age. The larger of the two is 73 mm. long, the smaller 50 mm., and both can be closely matched among fresh specimens of *ocellatus* collected by me in or near the city of Rio de Janeiro. The variation in the shape and position of the vomerine teeth in *ocellatus* is considerable, so that their greater distance apart in the type of *caliginosus* as compared to another example called *ocellatus* by Girard (1858, p. 32) is of no significance. Occasionally an adult *ocellatus* is found in which the longitudinal glandular dorsal folds are reduced or nearly lacking, and the occurrence of this condition in the larger of the two cotypes caused Girard to state that the skin was "smooth in the adult". The other supposed differences between *caliginosus* and *ocellatus* (in the former the phrenic region is more depressed, the upper eyelid less projecting, the arms shorter, and the thighs stouter) disappear when even a small series of *ocellatus* is studied and measured, provided that the great differences in bodily proportions due to age and sex, not realized by Girard, are considered.

Günther's citation of a Mexican "*caliginosus*" has been placed in the synonymy of *Leptodactylus melanonotus* (Hallowell), by Kellogg (1932, p. 88). If Girard had stated the total length (73 mm.) of the larger of his cotypes of *caliginosus*, the confusion begun by Günther's misidentification of the Museum Guilding specimens sent to the British Museum and listed in 1858 as *caliginosus* might not have occurred, since neither *podicipinus* Cope nor *melanonotus* (Hallowell) are over 50 mm. in length, these being the two species repeatedly called *caliginosus* by Boulenger and Günther. Even so, this cotype was far from being as large as some members of the species; USNM 97489, a female from Santa Alexandrina in the city of Rio de Janeiro, is 120 mm. long, and a male from Itá, Santa Catarina, USNM 103907, is 132 mm. long, while Müller and Hellmich (1936, p. 44) report the largest female from Chaco as being 108 mm. in length, and the largest male 95 mm.

These two authors (1936, p. 45) state that no geographic variation was apparent in their 271 Gran Chaco examples, except for a conspicuous dark coloration in those from Sierra Chica de Cordoba. They were thus unable to render an opinion as to the status of *L. ocellatus macrosternum.*

The unique type of *macrosternum* is a young female, now greatly faded, so that only a trace of the original pattern remains. It agrees closely in structural details with the rather good series of freshly collected *ocellatus* from Bahia and Minas Gerais, as well as with others of similar age and sex from Rio de Janeiro. No valid character can be found for separating the Bahian form, since the sternum of *macrosternum* is identical in size and shape with that of a Rio de Janeiran specimen, USNM 97397, of the same dimensions. The proportions of snout length, head width, and tibial length present the same degree of variation in each locality. The development of the dorsal folds is also the same in adults from Bahia and Rio de Janeiro. Some of the Rio de Janeiran *ocellatus* have immaculate venters, although many are spotted below.

The dimensions of the type of *macrosternum* are: Head and body 68 mm.; head length 23 mm., width, 22 mm.; tympanum 5 mm.; eye 8.5 mm.; interorbital width 3.5 mm.; foreleg from axilla ±36 mm.; hind leg from vent 120 mm.; hind leg from groin 114 mm.; femur 34 mm. (soft); tibia 36 mm.; foot from heel 57 mm.

Specimens examined

BRAZIL:

Amazonas: Hyutanahã, USNM 28969, Steere.

Bahia: Bahia, MHNP 4484, Dabadie; MP 448 (type of *L. o. macrosternum*). Bom Jardim, USNM 98823–5, Dias, Apr. 13, 1935. Jaguaray, USNM 52606, Rose, June 12, 1915. Joazeiro, USNM 98840–1, Dias, Apr. 16, 1935. Remanso, USNM 98828–37, Dias, Apr. 15, 1935. Salinas, USNM 119109–10, Johnson, February 1944. São Salvador, AMNH 49460–9, Snedigar, Oct. 20, 1937.

Ceará: Fortaleza, USNM 109136–40, von Ihering.

Districto Federal: Baixada Fluminense, MZUM 104211 (2), Bailey, 1941. Manguinhos, USNM 97380–93, Cochran, Feb. 11, 1935. Recreio dos Bandeirantes, USNM 97628, Campos, February 1935. Rio de Janeiro, USNM 7389 (2; cotypes of *L. caliginosus*), USNM 7357, 15477 (cotype of *L. serialis*), U. S. Exploring Expedition, 1839; USNM 70595–9 and 70604, Metcalf, October 1925; AMNH 17421, A. Lutz; ZSBS 117/0 and 122/0 (2; cotypes of *Rana pachypus*), Spix; ZSBS (1). Botanical Gardens, MRHN IG 9308 Reg. 54b, Massart, December 1922. Santa Alexandrina, USNM 97489, B. Lutz and Cochran, Feb. 1, 1935. Surupuhy, USNM 97397, Cochran, Dias, and Venancio, Mar. 6, 1935.

Espírito Santo: Itá, IB 132–8, 140–2, 146, 155–63, 166–71, 174, 195 a–e, 196, 201–4.

Minas Gerais: Bello Horizonte, USNM 97909–11, Cochran and Venancio, Mar. 15, 1935. Guaicuí, USNM 98804, Dias, Apr. 11, 1935. Januária, IB 410–1, 413, 261–4. Lassance, USNM, 98134–45, 98205–9, Cochran, Dias, and Venancio, March–April 1935; USNM 97006–14, A. Lutz, February 1922. Ouro Prêto, USNM 98045 (tadpoles), Cochran, Dias, and Venancio, Mar. 18, 1935. Pirapora, USNM 98261–7, Cochran, Dias, and Venancio, Mar. 22–23, 1935. Rio Pandeiro, IB 265–7 and 532. Yacará, USNM 98815–7, Dias, Apr. 11, 1935.

Paraíba: "Elembuzeiro," USNM 109135, von Ihering.

Rio de Janeiro: ZSBS 117/0, 122/0 (2; cotypes of *Rana pachypus*), Spix. Barro Branco, MZUM 104233, Bailey, 1941. Caxias, USNM 96219–20, Pinto. Nova Friburgo, USNM 97764, B. Lutz, Cochran, and Venancio, May 11, 1935. Teresópolis, ZSBS (4), Bresslau, February–March 1929.

Rio Grande do Norte: Cruzeta, USNM 109141, von Ihering.

Rio Grande do Sul: Pôrto Alegre, KZAEM 2522, Emrich, 1933. Santa Maria, IB 608.

Santa Catarina: Itá, USNM 103907, Plaumann, 1937.

São Paulo: Alto da Serra, MRHN IG 9308, Reg. 54, Massart, September 1922. Bertioga, USNM 123394–8, Sawaya. Butantan, IB 252–3, 180. Emas, DZSP 2435 and 2439, Vanzolini and Bokermann, December 1947. Juquiá, 8 kilometers north of, MZUM 104215, 104216 (3), 104226, 104233 (10), Bailey, 1941. Rechã, USNM 121284. Salgado, IB 123. Terceira Repressa, ZSBS (1), Schindler, Dec. 26–31, 1937.

ARGENTINA, BOLIVIA, URUGUAY: Additional specimens, not listed.

Leptodactylus pentadactylus flavopictus A. Lutz

Plate 29, Figures a–c

1926. *Leptodactylus flavopictus* A. Lutz, 1926a, pp. 5, 12 (type locality, Montserrat, Itatiaia, Rio de Janeiro); 1926b, pp. 144, 164, pl. 31, figs. 5, 6; 1930, pp. 10, 29.—B. Lutz, 1947, p. 247; 1949a, p. 4.

1926. *Leptodactylus pachyderma* Miranda-Ribeiro, p. 150, fig. 82 (type locality, Ilha Victoria, São Paulo); 1927, p. 123, pl. 1.

Description.—Adult female, IOC (type of *L. flavopictus*), Montserrat, Rio de Janeiro. Vomerine teeth in two exceedingly heavy, curved, nearly contiguous arcs between and behind the choanae; maxillary teeth present; tongue slightly over one-half as wide as mouth-opening, broadly heart-shaped, with a notch on its free posterior border; snout short and blunt when seen from above and in profile, the upper jaw scarcely projecting beyond the lower; nostrils superolateral, slightly projecting, their distance from end of snout one-half their distance to eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis blunt and not very apparent, the loreal region concave and nearly horizontal as it slopes widely to the flaring upper lip. Eye large and prominent, its diameter equal to its distance from nostril; interorbital diameter equal to the broad upper eyelid, equal to distance between nostrils. Tympanum large and very distinct, three-fourths the width of eye, separated from eye by an interval equal to its own diameter. Fingers free, with definite traces of a lateral fringe, the tips very slightly dilated into disks that appear to be grooved above; second and fourth subequal, reaching to base of penultimate phalanx of third; no pronounced pollex, but a large projecting oval tubercle at base of thumb, the subarticular tubercles well developed; toes fringed, the disks of the first and second not enlarged, the other three toes with slight grooved disks like those of fingers; third toe much longer than fifth, reaching nearly to base of penultimate phalanx of fourth; a blunt, oval inner and a very weak outer metatarsal tubercle; a very faint glandular ridge along inner side of tarsus; body very stout, in postaxillary region considerably greater than width of head; when hind leg is adpressed, heel reaches to anterior tympanic border; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are bent at right angles to body, heels barely overlap. Skin of top of head and center of back thick but very smooth; a heavy supratympanic glandular ridge which branches behind the tympanum, the shorter branch ending above the shoulder in a heavy glandular knob, the other branch widening at once to an extremely heavy lateral gland which thickens greatly opposite to the beginning of the sacrum and covers the whole side in front of the groin, bending on the back and covering the end of the body beside the coccyx; just behind this is a separate kidney-shaped gland on each side of the anus, while another very heavy gland covers the inferolateral border of the femur, the area between these glands and behind the anus and below the dorsolateral glands heavily granular, but the skin on the upper limb surfaces remarkably smooth; a heavy glandular knob behind the corner of the mouth; ventral surfaces smooth, except for the granules on the lower thigh. No glandular ridge on tip of snout. (Vocal sacs in the male?)

Dimensions.—Head and body 137 mm.; head length 47 mm., width 53 mm.; femur 60 mm.; tibia 62 mm.; foot 64 mm.; hand about 30 mm. (tip of third finger missing).

Color in alcohol.—Head and center of back olive; an Indian-purple stripe beginning as a narrow line on canthus, widening behind ear and making a wide dorsolateral stripe above the lateral glands on the smooth skin of the back, where it is separated by a straight line of black dots from the dorsal ground color; lower part of glands marked irregularly with black; an irregular black spot in the groin; femur with narrow but fairly regular black crossbands above, and black with a few pale spots posteriorly; tibia and tarsus with irregular prominent black spots and bars, with a few paler ones across the arm; posterior surfaces of tarsus, foot, forearm, and upper arm black; upper lip with two triangular dark spots separated by pale lines below eye, the pale border to the hindmost triangle continuing forwards indistinctly to nostril and backwards below tympanum to shoulder, ending on the glandular knob behind the mouth; lower lip with pale broken ocelli on a plumbeous ground; entire chin and throat dark plumbeous with numerous small round buff spots; remainder of ventral region buff, with slight dusky marblings on chest and sides of abdomen, and darker mottlings below tibia and foot.

Color in life.—From the published figure of the type (Lutz, 1926): Dorsum light burnt umber; a wide chocolate dorsolateral stripe, the sides below this tawny-olive to wax yellow with darker spots; legs reddish chocolate with maroon spots and crossbars, toes and fingers lightening to drab. Chin and throat dull sepia with small yellow spots; ventral surface mottled white and gamboge yellow, very intense across abdomen and on lower femur, the yellow mottling gradually obscured by dull sepia on forearm and tibia; palms of hands nearly uniform sepia.

Remarks.—No specimen other than this one has been collected at the type locality. It was found by Zikan under stones, on the edge of a lake, a habitat like that of *L. ocellatus* and *L. pentadactylus pentadactylus* Laurenti. The voice of the male is unrecorded.

In examining adult examples of typical *pentadactylus* from British Guiana and Costa Rica, I have noted that in smoothness of skin and in color pattern these specimens closely approach *flavopictus*. Only a large series of the latter can make it possible to verify this resemblance. On the type of *flavopictus* the lateral and postfemoral glands stand out far more than on any specimen of *pentadactylus* compared with it (for example, USNM 109148, Maranguape, Ceará, and USNM 109144, Campina Grande, Paraíba), and this condition alone distinguishes it from *pentadactylus*, which has a narrow dorsolateral gland and at most a few small scattered glands on the sides.

In a comparison of the type of *flavopictus* with an example of *labyrinthicus* (USNM 121286) nearly the same size, the following differences were noted:

L. p. labyrinthicus	*L. p. flavopictus*
distance of nostrils from end of snout equal to their distance from eye	one-half that distance
eye diameter a little greater than its distance from nostril	equal
interorbital diameter slightly less than distance between nostrils	equal
fingers not grooved above	slightly grooved
heel reaches to nostril	to anterior tympanic border
knee and elbow overlap	fail to meet
heels overlap	barely overlap
no heavy lateral or postfemoral glands	these glands very heavy

In addition, the actual length and width of head in *flavopictus* fall below the critical limits of *labyrinthicus* on the statistical chart, thus indicating that the head may be both shorter and narrower in proportion to the body length in *flavopictus* than in *labyrinthicus*. More specimens from Itatiaia are needed to settle this point finally, however.

Specimens examined

BRAZIL:

Rio de Janeiro: Montserrat, Itatiaia, IOC (type of *L. flavopictus*), Zikan, December 1924.

***Leptodactylus pentadactylus labyrinthicus* (Spix)**

Plate 28, Figures e, f

1824. *Rana labyrinthica* Spix, p. 31, pl. 7, figs. 1, 2 (type locality, [State of] Rio de Janeiro).

1841. *Cystignathus labyrinthicus* Duméril and Bibron, p. 407.—Guichenot, 1855, p. 79, pl. 16.—Reinhardt and Lütken, 1862, p. 165.—Steindachner, 1867, p. 23, pl. 5, fig. 5.

1853. *Leptodactylus labyrinthicus* Girard, p. 420.

1858. *Pleurodema labyrinthica* Günther, p. 31.

1862. *Cystignathus hylodes* Reinhardt and Lütken, p. 168 (type locality, Maruim, Sergipe).—Boulenger, 1882a, p. 237.

1865. *Gnathophysa labyrinthica* Cope, 1865b, p. 112.

1882. *Leptodactylus pentadactylus* (part) Boulenger, 1882a, p. 241.—Günther, 1901, p. 212.—Peracca, 1904a, p. 12.—Andersson, 1906, p. 9.—Baumann, 1912, p. 162.—Nieden, 1923, p. 473.—A. Lutz, 1924a, p. 235; 1926b, pp. 143, 162, pl. 30, figs. 1, 2, 5, 6, pl. 34, figs. 2, 3; 1930, pp. 12, 31.—Brazil and Vellard, 1926, p. 21, pl. 9.—Miranda-Ribeiro, 1926, p. 147, fig. 80; 1927, pp. 114, 131; 1937a, p. 56.—Mertens, 1926a, p. 6, figs. 3, 4.—deWitte, 1930a, p. 225.—Mello-Leitão, 1937, p. 268.—Carvalho, 1939a, p. 280.—Schubart, 1939, p. 54.—Travassos and Freitas, 1942, p. 283.—B. Lutz, 1947, p. 247.

1927. *Leptodactylus pentadactylus labyrinthicus* L. Müller, p. 276.—Müller and Hellmich, 1936, p. 46, fig. 16.—B. Lutz, 1949a, p. 4.

Description.—Adult male, USNM 121286, Jurú Mirim, São Paulo. Vomerine teeth in two exceedingly heavy, curved, nearly contiguous arcs between and behind the choanae; maxillary teeth apparent; tongue almost two-thirds as wide as mouth-opening, widely oval, with a notch on its free posterior border; snout short and blunt when seen from above and in profile, the upper jaw scarcely projecting beyond the lower; nostrils superolateral, slightly projecting, their distance from end of snout equal to their distance from eye and to the interval between the nostrils. Canthus rostralis bluntly rounded, the loreal region concave, and flaring out to the upper lip. Eye large and prominent, its diameter a little greater than its distance from nostril; interorbital diameter equal to that of upper eyelid, silghtly less than distance between nostrils. Tympanum large and distinct, three-fourths the width of eye, separated from eye by an interval nearly equal to its own diameter. Fingers free, with lateral ridges, tips very slightly dilated into disks which are not grooved above, fourth a little longer than second, much shorter than first, reaching halfway on penultimate phalanx of third; a very pronounced spur on outside of first finger, a heavy tubercle at base of thumb and a larger irregular one on palm of hand; the subarticular tubercles well developed; toes with lateral ridges, their disks a trifle enlarged, the second and third with traces of a groove on top, third toe much longer than fifth, reaching beyond base of antepenultimate phalanx of fourth; a small but prominent inner metatarsal tubercle and a round flattened outer one; a heavy, curving, glandular ridge along inside of tarsus. Body stout, in postaxillary region a little less than the greatest width of head. When hind leg is adpressed, heel reaches to nostril; when limbs are laid along the side, knee and elbow overlap; when hind legs are bent at right angles to body, heels overlap considerably. Skin of dorsum highly glandular; a dorsolateral ridge from behind eye to sacrum where it becomes lower but much wider, involving the whole inguinal region; between these folds a number of large and small warts, especially heavy and large on the sacral region; a heavy supratympanic ridge extending behind the tympanum in a triangular gland ending in a knob in front of shoulder; a transverse fold of skin above the anus; skin on upper surface of legs heavy and glandular but not especially thickened; a heavy tarsal skinfold; venter smooth with a slight ventral disk; postfemoral areas granular; forearms greatly enlarged in the male. In the breeding season a large horny black tubercle on either side of the chest appears, as well as a black horny covering to the projection on the side of the first finger.

Dimensions.—Head and body length 146 mm.; head length 52 mm., width 59 mm.; femur 67 mm.; tibia 71 mm.; foot 72 mm.; hand 37 mm.

Color in alcohol.—Dorsum wood brown, with lighter indistinct suffusions; bases of dorsolateral glands and tubercles darker brown; upper lip with three slanting diagonal light stripes outlined by darker areas; groin and posterior femur light buff (yellow or red in life) with heavy dark reticulations. Venter buff with a coarse dark network, which is less dense posteriorly, but almost solid brown on the throat; soles and palms dark with light tubercles.

The color pattern on the head of young *labyrinthicus* is striking and much brighter than that of adults. The complete color description of a 26 mm. *labyrinthicus*, MP 1011, is given here: Dorsum ecru-drab, darkening posteriorly; a narrow sepia crossbar between the eyes, edged anteriorly by a pale, wide, drab bar, the top of the snout anterior to this pale bar being dull sepia; a narrow dark line along canthus, the loreal and lip region below this being white, with a faint brown reticulation on the edge of the lip; a narrow dark line bordering the glandular dorsolateral fold; a transverse dark bar across the nape between these two lines but not connecting with them; upper surfaces of arms with dark crossbars, those on upper surfaces of leg much less distinct; posterior surface of femur sepia with numerous small white spots; venter immaculate cream buff.

Remarks.—I follow Dr. Lorenz Müller (1927) in attributing the "bull-frogs" of Brazil south of the Amazon region to the subspecies *labyrinthicus*. The statistical analysis of 34 specimens of this group from British Guiana to Paraná does not show any significant geographic variation in any of the six critical measurements.

The dorsolateral folds are strong in São Paulo frogs and in some from Kartabo, British Guiana. They are moderate in one from São Paulo, three from Goiás and Mato Grosso, and four from Venezuela and Amazonas. The dorsum is rough in São Paulo frogs, and equally so in one from Kartabo, although most of the northern ones are smooth. One from Amazonas, two from British Guiana, two from Mato Grosso, and two from São Paulo have well-developed lateral glands, but other specimens from the same localities lack them. A postfemoral gland occurs in one from Mato Grosso and in two from São Paulo. Thus, the usual details of structure vary considerably, as much so in frogs coming from the same state as between those from the northern and southern limits of the range.

No conclusion can be reached regarding the Itatiaia form *flavopictus* until more specimens have been studied; until then it seems best to recognize it as a subspecies of *Leptodactylus pentadactylus*.

Some large adults of *L. p. pentadactylus* from Ceará, Rio Grande do Norte, and Paraíba have a row of irregular, rounded glands from behind the tympanum along the sides to the groin. In USNM 109144 from Campina Grande, Paraíba, these glands are particularly prominent. They do not become elongate, however, as in the unique specimen of *L. p. flavopictus*, which has two very regular long glands, one above the shoulder, the other in front of the groin. In 109144 four or five large beadlike glands extend from the ear halfway down the side, followed by a few weak ones, and some larger and heavier glands occur just in front of the groin. This specimen, a male, has a head and body length of 181 mm., with enormously developed spurs on chest and pollex, the latter almost as long as the first finger, so that this digit appears double. A trace of the original reddish ground color remains on the femur of some of these frogs, although the back and upper limb surfaces are now a uniform sooty black.

Specimens examined

BRAZIL:

Bahia: Bahia, MHNP 4496, Dabadie; MHNP 4568, Brunet.

Minas Gerais: Bello Horizonte, USNM 96978–80, de Mello. Januária, IB 412. Lagôa Santa, UZMK 184–5, Reinhardt. Lassance, USNM 97015, A. Lutz, February 1922. Santa Rita, Lassance, USNM 98786–7, Dias, 1935.

Rio de Janeiro: USNM 70593, A. Lutz. Teresópolis, MP 1011, Miranda-Ribeiro, 1922.

São Paulo: NMZ 3524, von Ihering. Bertioga, USNM 123393, Sawaya. Capital, USNM 121285 and IB 079. Colombia, IB 83. Jurú Mirim, USNM 121286, Instituto Butantan. Luzitania, IB 212–3. Ribeirão Prêto, USNM 100970. São Paulo, USNM 100971, Worontzow.

Non-Brazilian specimens not listed.

Leptodactylus podicipinus **(Cope)**

Plate 29, Figures d–f

1858. *Cystignathus caliginosus* (not of Girard) Günther, p. 28.

1862. *Cystignathus podicipinus* Cope, 1862a, p. 156 (type locality, Paraguay); 1862b, p. 353.

1876. *Cystignathus calliginosus* (sic) Weyenbergh, p. 165.

1881. *Leptodactylus caliginosus* (not of Girard) Boulenger, p. 30; 1882a (part), p. 248; 1889, p. 247; 1894, p. 348; 1898a, p. 132; 1903b, p. 481.—Peracca, 1895, p. 28; 1904a, p. 12; 1904b, p. 34.—Berg, 1896, pp. 150, 182.—Günther, 1901, p. 214.—Méhely, 1904, p. 223.—Baumann, 1912, p. 162.—Beebe, 1919, p. 209; 1925, p. 124.—Ruthven, 1919, p. 4.—Nieden, 1923, p. 491.—Marelli, 1924, p. 586.—Cott, 1926, p. 1160.—Miranda-Ribeiro, 1926, p. 149, fig. 81; 1927, pp. 114, 116.—A. Lutz, 1926b, pp. 151, 170; 1927, pp. 39, 45; 1930, pp. 2, 22, pl. 2, figs. 1–3, pl. 3, fig. 4, pl. 4, fig. 2.—Crawford, 1931, p. 31.—Parker, 1934b, p. 266.—Müller and Hellmich, 1936, p. 36, fig. 13.—Hellmich, 1939, p. 537.—Carvalho, 1939a, p. 280.—Melin, 1941, p. 56, fig. 31.—Myers, 1946, pp. 10, 28.—Shreve, 1947, p. 536.

1882. *Leptodactylus podicipinus* Boulenger, 1882a, p. 248.—A. Lutz, 1930, pp. 4, 24, pl. 3, fig. 3, pl. 4, figs. 1, 1a.—Parker, 1940, p. 203.—Mello-Leitão, 1937, p. 342.

1926. *Leptodactylus nattereri* A. Lutz, 1926c, p. 1011 (type localities, Ilha Sêca and Cachoeira do Maribondo, São Paulo).

1930. *Leptodactylus natalensis* A. Lutz, pp. 7, 26, pl. 1, figs. 7, 7a, pl. 3, figs. 1, 2 (type locality, Rio Grande do Norte).

Description.—Adult male, USNM 98801, Pirapora, Minas Gerais. Vomerine teeth in two narrowly separated patches behind and between the choanae; tongue more than one-half the width of mouth-opening, heart-shaped, with a slight notch on its free posterior border. Snout rather short, bluntly rounded when seen from above, nearly vertical in profile, without a shovellike rim, upper jaw projecting slightly beyond the lower. Nostrils superolateral, not projecting, their distance from end of snout a little less than their distance from eye, separated from each other by an interval equal to twice their distance from end of snout. Canthus rostralis rounded, indistinct;

the loreal region slightly concave and forming a very obtuse angle with the flaring upper lip. Eye large, prominent, its diameter equal to its distance from end of snout; interorbital diameter a little greater than width of upper eyelid, equal to distance between nostrils. Tympanum large, distinct, two-thirds the eye diameter, separated from eye by one-third its own diameter. Fingers free, with distinct lateral ridges, first and second subequal, a trifle longer than fourth, reaching halfway on penultimate phalanx of third; a crescentic pad at base of thumb representing remnant of pollex; a small bifurcate palmar tubercle; subarticular tubercles well developed. Toes webbed at the base, with wide lateral fringes; third longer than fifth, reaching nearly to base of penultimate phalanx of fourth; a small conical inner and a minute indistinct outer metatarsal tubercle; a very heavy fold along inside of tarsus extending nearly to heel and continuous with the lateral fringe on outside of first toe. Body fairly stout, in postaxillary region a little narrower than width of head; when hind leg is adpressed, heel reaches to center of eye; when limbs are laid along the body, knee and elbow touch; when hind legs are laid at right angles to body, heels just meet. Skin above minutely pustular, with heavier glands on sacrum and on the sides; a short, weak supratympanic ridge; venter smooth except for some elongate glandules on posterior femur; no apparent ventral disks or mouth glands. Some folds at the corner of the mouth, indicating lateral vocal sacs, and two sharp conical spines on the outside of the thumb.

Dimensions.—Head and body 34 mm.; head length 12 mm., width 12 mm.; femur 14 mm.; tibia 15 mm.; foot 17.5 mm.; hand 8 mm.

Color in alcohol.—Dorsum dark sepia; a black interorbital bar, the area in front of it light brown; dark crossbands on upper surfaces of legs; posterior femur light drab with many small dark spots tending to form borders to a central light area; venter olive drab, with darker mottlings especially prominent posteriorly; edge of upper lip light brown; a wide brown stripe from loreal region through tympanum, along the sides to groin, ending halfway down anterior surface of femur; soles of feet and tarsus dark brown.

Remarks.—I collected an example of this species in a pit beneath the railroad tracks in the town of Pirapora, Minas Gerais, and subsequently received three additional specimens from the same town. Two males in this lot show the two black spurs on each thumb. In structural details all of them closely resemble Central American examples of *L. melanonotus* (Hallowell), especially in the shape of the head and in the character of the skin, which in breeding males is beset with very small spiny tubercles, but is otherwise nearly smooth. The hind leg of *melanonotus* appears to be shorter. All the three adults from Pirapora have the second finger as long as the first, their only point of difference from Cope's original description of *podicipinus*, excepting their slightly smaller dimensions. One of them, USNM 98801, has been compared with the type of *podicipinus*, ANS 14359, by Dr. E. R. Dunn, who finds them conspecific.

Günther's incorrect identification of British Museum specimens *m* through *r*, also listed by Boulenger (1882a, p. 248) as *caliginosus*, seems to be the source of all the subsequent errors in defining that name. They are definitely *podicipinus*, and not *ocellatus*.

There can be no possibility of confusing *L. validus* Garman with *podicipinus*. The presence of a wide lateroventral gland in the males of *validus*, extending from the axilla nearly to the groin, and a similar postfemoral gland ending below the knee and reaching halfway to the anus (both glands deep chrome yellow in well-preserved specimens) serve to distinguish this species. Neither *melanonotus* nor *podicipinus* appear to have such glands, although *podicipinus* has the skin of these areas somewhat thickened. The ventral coloration also distinguishes *podicipinus* from *validus*, as it is dusky spotted with light in the former and immaculate cream in the latter except for the clouded throat. The coloration of the posterior femur is different, being spotted light and dark in *podicipinus*, while the glandular area in *validus* is marked by a black stripe, with a yellow one on each side running lengthwise of the gland. In all other features the two species show their close relationship, the vomerine teeth likewise being nearly identical.

Bolivian specimens CM 2508 (adult) and 2509, and USNM 115973 (half grown) are not exactly like the specimens from Maracajú in Mato Grosso, or from Minas Gerais, as the ventral coloration is much lighter, and in 2508 the two postanal glands are much more prominent and dark colored. The dorsum is also not so rough, and in 2508 and 115973 the triangular dark mark between the eyes is less well defined posteriorly. But if these Bolivian frogs are not true *podicipinus*, they are very closely related to that species.

Specimens examined

BRAZIL:

MINAS GERAIS: Pirapora, USNM 98535, 98801–3, Cochran, March 1935. Rio Pandeiro, IB 503.

RIO DE JANEIRO: Guapi, Teresópolis, NMS (2), Giesler.

RIO GRANDE DO NORTE: Natal, USNM 81130 (cotype of *L. natalensis*) A. Lutz, 1925.

SÃO PAULO: São Paulo, CM 2465.

BOLIVIA: Buena Vista, USNM 118687–8, Steinbach. Río Guaporé, CM 2508–9, Haseman, July 18, 1909. Swamp along Río Guaporé, USNM 115973, Haseman, July 27, 1909.

Leptodactylus sibilatrix (Wied)

PLATE 28, FIGURES G, H

1802. *Rana typhonia* (not of Linnaeus) DAUDIN, p. 106, pl. 17, figs. 3, 4; 1803, p. 106, pl. 95, figs. 1, 2.—ANDERSSON, 1900, p. 25.
1824. *Rana pachypus* var. 2, SPIX, p. 26, pl. 3, fig. 2 (specimen from Pará).—WIED, 1825, p. 540.
1824. *Rana sibilatrix* WIED, 1824b, p. 671 (type localities, Rio Peruhypa [? Peruipe], near Villa Viçoza, and Rio Mucuri); 1824a, pl. [47], fig. [2]; 1825, pp. 545, 606.
1824. *Rana mystacea* SPIX (part), p. 27, pl. 3, figs. 1–3 (type localities, Bahia, Solimoēs).—PETERS, 1873a, p. 201.
1826. *Leptodactylus typhonia* FITZINGER, p. 64.
1826. *Lèptodactylus sibilatrix* FITZINGER, p. 64.
1830. *Cystignathus mystacea* WAGLER (part), 1830a, p. 203.
1830. *Cystignathus typhonia* WAGLER, 1830a, p. 203.
1830. *Cystignathus sibilatrix* WAGLER, 1830a, p. 203.
1838. *Cystignathus ocellatus* TSCHUDI (part), p. 78.
1841. *Cystignathus typhonius* DUMÉRIL and BIBRON, (part), p. 402.—REINHARDT and LÜTKEN, 1862, p. 164.—STEINDACHNER, 1867, p. 24.—PETERS, 1876, p. 709.
1848. *Cystignathus schomburgkii* TROSCHEL, p. 659 (type locality, British Guiana).
1858. *Cystignathus gracilis* (not of Duméril and Bibron) GÜNTHER, p. 28.—HENSEL, 1867, p. 130.
1882. *Leptodactylus typhonius* BOULENGER, 1882a, p. 246; 1898a, p. 131; 1903a, p. 69.—BOETTGER, 1892, p. 31.—BERG, 1896, pp. 150, 184.—PERACCA, 1897, p. 17.—BUDGETT, 1899, pp. 305–6.—SCHNEE, 1900, p. 464.—BRANDES and SCHOENICHEN, 1901, p. 403.—MÉHELY, 1904, p. 222.—ANDERSSON, 1906, p. 9.—BAUMANN, 1912, p. 94; 1917, p. 139.—RUTHVEN, 1919, p. 3; 1922, p. 54.—BEEBE, 1919, p. 209.—NIEDEN, 1923, p. 486.—A. LUTZ, 1924a, p. 235; 1926b, pp. 146, 165, pl. 32, figs. 1–3, pl. 33, figs. 1, 2; 1927, pp. 39, 46, pl. 12, figs. 21, 22; 1930, pp. 14, 32.—MIRANDA-RIBEIRO, 1926, p. 145, fig. 77; 1927, pp. 114, 127; 1937a, p. 56.—DE-WITTE, 1930a, p. 225.—CRAWFORD, 1931, p. 30.—AHL, 1931a, p. 3 in sep., photogr.—EISENTRAUT, 1932, p. 317.—SCHUBART, 1939, p. 54.
1927. *Leptodactylus sibilator* L. MÜLLER, p. 281.—MÜLLER and HELLMICH, 1936, p. 51, fig. 18.—MERTENS, 1937, p. 144.—HELLMICH, 1939, p. 391.
1935. *Leptodactylus sibilatrix* PARKER, p. 509.
1936. *Leptodactylus plaumanni* AHL, p. 389 (type locality, Nova Teutonia, Santa Catarina).

Description.—Adult male, USNM 98271, Pirapora, Minas Gerais. Vomerine teeth in two strong, transverse, narrowly separated series behind and between the choanae; tongue one-half as wide as mouth opening, broadly oval, without a notch on its free posterior border. Snout long, obtusely pointed when viewed from above; seen in profile, snout shows a ridge which extends back along upper lip to tympanum; upper jaw projecting considerably beyond lower. Nostrils more superior than lateral, not projecting, their distance from end of snout about three-fourths their distance from eye, separated from each other by an interval equal to their distance from end of snout. Canthus rostralis rounded but distinct; loreal region flat, sloping, forming an obtuse angle with the flaring upper lip. Eye large, prominent, its diameter equal to three-fourths its distance from end of snout; interorbital diameter about two-thirds the width of upper eyelid, equal to distance between nostrils. Tympanum large, distinct, one-half the width of eye, separated from eye by an interval equal to one-half its own diameter. Fingers free, without perceptible lateral ridges, fourth a little longer then second, reaching to base of penultimate phalanx of third, first somewhat longer than fourth, reaching almost to base of last phalanx of third; a projecting, oval tubercle at base of thumb and a larger flat heart-shaped palmar tubercle. Toes webbed at the base, without lateral ridges, third slightly longer than fifth, reaching to one-fourth of the length of the antepenultimate phalanx of fourth; a small conical inner and a smaller round outer metatarsal tubercle; a glandular ridge on tarsus extending nearly to heel. Body moderately stout, in postaxillary region narrower than head width; when hind leg is adpressed, heel reaches between eye and nostril; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels overlap. Skin of upper parts smooth except for a few pustules posteriorly; a pair of narrow glandular dorsolateral folds and two fainter folds near the middle of back, a short supratympanic ridge merging with a heavy lateral skinfold extending to groin; a prominent gland behind corner of mouth; a distinct series of glands along posterior femur; venter smooth except for a large granular patch on lower femur and at sides of anus; a distinct ventral disk. A long crescentic fold on either side of the throat indicates the presence of lateral internal vocal sacs.

Dimensions.—Head and body 39.5 mm.; head length 14 mm., width 13 mm.; femur 16.5 mm.; tibia 20 mm.; foot 18.5 mm.; hand 8.5 mm.

Color in alcohol.—Dorsum olive-gray; a rhomboidal brown spot between the eyes extending halfway across the upper eyelid; three irregular brown spots arranged transversely on the back at level of shoulders; several larger but less distinct spots on center and posterior back; dorsolateral and lateral lines white; ridge around upper lip white, also lower part of gland behind corner of mouth. A few small dark spots edging some scattered glands on the sides; a dark stripe beginning at tip of snout, covering loreal and tympanic regions and ending on upper part of gland behind mouth; several wide brown crossbands on upper leg surfaces; posterior femur with a white line following the row of glands, bordered above and below by brown lines; a less apparent light line on center of posterior femur paralleling the glandular white line; a light brown stripe on anterior and posterior surfaces of upper arm. Venter pale buff, immaculate except for some gray dots around the chin; lower sides of tarsus and sole of foot dark brown.

Variations.—Occasionally a wide white middorsal stripe is present. The brown dorsal spots then appear to be paired on each side of the white stripe, and as three or four series of these are present, the pattern suggests a checkerboard.

Remarks.—This species closely resembles *L. mystaceus.* The characteristics that separate them seem to be quite constant, however; the two prominent dorsolateral folds extend from tympanum to groin in *mystaceus,* while *sibitatrix* has four and often six folds, the more dorsal ones beginning behind the shoulders. The former has a longer snout with a straighter labial border and a more rounded tip, while the latter has a shorter snout, convex in outline, and distinctly pointed at the tip. The coloration is also partly diagnostic, since *mystaceus* does not have the wide light dorsal stripe frequently found in *sibilatrix.* The dark dorsal spots of the latter are also smaller and more conspicuous than in *mystaceus,* while the dark interocular triangular patch, entire in *mystaceus,* is broken in *sibilatrix* whenever a light dorsal stripe occurs.

The eggs of *sibilatrix* are deposited in a mass of foam in holes near water. The young emerge and may be found in adjoining fields. The call of the male is a long distinct whistle, rapid at first, then slow, as - - - - ——— ———. It is found living in many of the same regions as its allies *mystaceus* and *mystacinus.*

Specimens examined

BRAZIL:

Amazonas: "Lower Amazonia," USNM 28924–5, 28967–8, 28970–1, 28973, Steere.

Espírito Santo: Itá, IB 131.

Minas Gerais: Januária, IB 412. Lagôa do Curralinho, near Lassance, USNM 98210, Cochran, Dias, and Venancio, Mar. 22, 1935. Pirapora, USNM 98268–71, Cochran, Dias, and Venancio, Mar. 23, 1935 Piraporinha, USNM 98548, Cochran, Dias, and Venancio, Mar. 23, 1935. Rio Pandeiro, IB 277, 475–6, 479–80, 485–6, 533–4, 536.

Rio de Janeiro: Campo Bello near Montserrat, USNM 96944–5, Zikan, 1923–4. Entre Rios, USNM 97218, Venancio, December 1922. Fazenda Niagara near Barreira, ZSBS 266, Bresslau, December 1913. Guapi, Teresópolis, USNM 97678–9, Sandig, 1935. Sacco São Francisco, near Niterói, USNM 99119, Venancio, Feb. 14, 1935.

Rio Grande do Sul: Santa Maria, IB 615.

Santa Catarina: São Bento, USNM 97174–5, Behr, 1915 (identity questionable).

São Paulo: Capital, IB 178. Emas, DZSP 2422, 2432, 2437, 2440–2, 2489, Vanzolini and Bokermann, December 1947. São Paulo, IB 600.

TRINIDAD: USNM 12163. Port-of-Spain, USNM 102392–400.

VENEZUELA: Chichare, USNM 36369–70, Cherrie, May 1905. Puerto Ayacucho, USNM 80675, Holt, Mar. 7, 1930. San Antonio, Upper Río Orinoco, USNM 83618, 83620–2, Holt, Mar. 8–9, 1931.

Leptodactylus troglodytes A. Lutz

PLATE 30, FIGURES A–D

1926. *Leptodactylus troglodytes* A. LUTZ, 1926b, pp. 149, 168, pl. 32, fig. 12 (type locality, Pernambuco); 1930, pp. 13, 32.

Description.—Adult male, USNM 97048, Caminho da Macahyba, Natal, Rio Grande do Norte. Vomerine teeth in two heavy Λ-shaped, nearly contiguous long patches between and behind the choanae; tongue half as wide as mouth-opening, widely notched on its free posterior border; snout blunt and truncate at the tip when seen from above, bluntly rounded in profile, the upper jaw extending only slightly beyond lower; nostrils superolateral, scarcely projecting, their distance from end of snout less than one-third that from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis rounded and indistinct; loreal region slightly concave and slanting outwards to the widely flaring upper lip. Eye large and prominent, its diameter equal to its distance from nostril; interorbital diameter equal to width of upper eyelid, slightly less than interval between nostrils. Tympanum very large and distinct, almost as great as eye diameter. Fingers free, not fringed, their tips pointed and without grooves, first much longer than second, which equals fourth; no pronounced pollex, but palmar and subarticular tubercles well developed; toes without webs or fringes, their tips similar to those of fingers, third longer than fifth and reaching beyond base of antepenultimate phalanx of fourth; a small prominent oval inner and a round outer metatarsal tubercle; a blunt, low tarsal ridge from inner tubercle to heel; body fairly stout, in postaxillary region equal to greatest width of head; when hind leg is adpressed, heel reaches to posterior corner of eye; when limbs are laid along the sides, knee and elbow are well separated; when hind legs are bent at right angles to body, heels slightly overlap. Skin of upper parts entirely smooth except for a few faint granules on top of snout; a weak supratympanic ridge; ventral surface smooth except for some granules on posterior thighs and below arms. Apparently no discoidal abdominal fold or skinfold across the chest. Male probably with internal vocal sac and without spurs on the hand.

Dimensions.—Head and body 51 mm.; head length 18 mm., width 18 mm.; femur 20 mm.; tibia 21 mm.; foot 18.5 mm.; hand 11 mm.

Color in alcohol.—Dorsum cinnamon, lightening to fawn on sides and limbs; traces of four or five large irregular squarish spots down middle of back and a few similar dorsolateral spots; dark crossbars on tibia and femur; venter pale drab, immaculate.

Color in life.—From a watercolor of a cotype from Pernambuco: Dorsal ground color pale russet; a clove-brown interorbital spot, followed by a series of spots on the sides; limbs dull pea green, the hind legs heavily crossbarred with sepia, the forearm lightly crossbarred.

Remarks.—Although only eight examples of this species have been critically measured, its relationship to *L. mystacinus* in body proportions as well as color seems to be established. In head length, *L. troglodytes* exceeds *mystacinus*, and, in fact, it exceeds all other Brazilian leptodactylids with the exception of *L. gracilis*, which barely overlaps it. In head width, length of femur, tibia, foot, and hand there is considerable overlapping with *mystacinus*, and in foot length especially is the agreement significant since all other leptodactylids have considerably longer feet than do these two.

A young specimen from Areia Preta is very close to the described specimen in markings, of which some are more distinct on the upper lip, where four nearly square light-bordered brown spots extend from beneath the eye to tip of snout. The tibia in this frog is a little longer than in the adult from the same locality; its extremely heavy vomerine teeth and large and distinct tympanum, however, as well as other important characteristics, serve to identify it rather definitely.

The cotypes of this species are from Pernambuco, but specimens were later found near Natal, Rio Grande do Norte, where these frogs are abundant but difficult to catch, as they live in very deep holes in the rocks on the margins of salt-water lagoons, although not actually in the ocean. They breed in June or July, probably leaving their eggs in suitable damp places. The voice of the male sounds like the *trint-trint-trint-trint* of a cricket as he sings from near the water. They are called cassota or caçota in Rio Grande do Norte and Pernambuco. Their color is similar to that of *mystacinus*.

Specimens examined

BRAZIL:
  Bahia: BM 69.11.3.23, Cutter.
  Minas Gerais: Rio Pandeiro, USNM 121300.
  Rio Grande do Norte: Areia Preta, USNM 97049, A. Lutz, Aug. 7, 1928.
    Caminho da Macaíba, near Natal, USNM 97048, A. Lutz, July 1928.

Genus *Megaelosia* Miranda-Ribeiro

1923. *Megaelosia* Miranda-Ribeiro, 1923b, p. 819 (Genotype *Elosia bufonia* (not of Girard) = *Hylodes goeldii* Baumann.)
1931. *Megalelosia* A. Lutz, pp. 227, 236 (emendation).

Generic diagnosis.—General form of *Elosia* with a sexual dimorphism much more accentuated in the difference in size, the female being commonly twice as large as the male. When fully adult, the mandible of the latter shows a plate of complete odontoids, which do not penetrate the skin, remaining entirely hidden under it. The symphysis begins in two superior processes which are packed into a corresponding depression at the base of the maxillaries. The larvae are quite large, larger than those of *Pseudis;* those of males equal the body length of metamorphosed females, and those of females double this length.

It seems fitting to accept the full generic status for this giant frog, which attains a larger size than any other in Brazil except *Leptodactylus ocellatus*, *Hyla maxima*, and *Bufo marinus* and its allies. It is closely related to *Elosia* in the possession of small but prominent patches of vomerine teeth, in its typically divided upper toe and finger disks, and in its fringes around the digits, while its chief differences from *Elosia* lie in its broader head, shorter hand and tibia, and in its much greater size.

***Megaelosia goeldii* (Baumann)**

Plate 30, Figures e–g

1912. *Hylodes goeldii* Baumann, pp. 91, 161, pl. 4, figs. 2,a, 2,b (type locality, Organ Mountains, Rio de Janeiro).—Nieden, 1923, p. 462.

1923. *Megaelosia bufonia* (not of Girard) Miranda-Ribeiro, 1923b, p. 820; 1926, p. 28, figs. 14, 15, pl. 3.—Mello-Leitão, 1937, p. 329.

1927. *Elosia goeldii* L. Müller, p. 270.

1930. *Elosia massarti* deWitte, 1930a, p. 221, pls. 2, 3 (type locality, Alto da Serra, São Paulo).

1931. *Megalelosia goeldii* A. Lutz, p. 236, pl. 65, figs. 12, 13, pl. 67, figs. 26–28.

Description.—Adult female, USNM 96763, Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth in two short, heavy, well-separated, transverse patches between the posterior borders of the choanae; tongue about one-third as wide as mouth-opening, nearly round, not indented on its slightly free posterior border; snout bluntly pointed when viewed from above, truncate in profile, the upper jaw extending well beyond the lower; nostrils lateral, scarcely projecting, midway between snout and anterior corner of eye, separated from each other by an interval equaling about 1½ times their distance from eye; canthus rostralis rounded, sloping into the concave loreal region; upper lip flaring out from loreal region and bluntly ridged for its entire length. Eye large and prominent, its diameter very nearly as great as its distance from end of snout; interorbital diameter about 1⅔ times the width of upper eyelid, equal to that between nostrils. Tympanum small, not very prominent, separated from eye by an interval equal to twice its own diameter. Fingers free, their tips dilated into small disks, their sides with narrow dermal fringes, fourth much longer than second, which reaches only to base of antepenultimate phalanx of third; first finger shorter than second; no prominent pollex, but a wide padlike palmar tubercle and a smaller one on base of first finger; toes webbed at the base, their disks like those of fingers; third toe a little longer than fifth, reaching almost to base of penultimate phalanx of fourth; a long blunt inner metatarsal tubercle and a small round outer one; a wide dermal fringe along inside of tarsus, and another along outer side of fifth toe. When leg is straightened, heavy skinfolds appear at knee and heel. Body stout, in postaxillary region narrower than the very broad head. When hind leg is adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow overlap; when hind legs are bent at right angles to body, heels touch. Skin of upper parts heavily glandular, with elongate tubercles on the sides from above tympanum to groin; top of head, center of back and upper limb surfaces relatively smooth. Center of chin, chest and posterior femur slightly shagreened, rest of ventral surfaces nearly smooth.

Dimensions.—Head and body 100 mm.; head length 36.5 mm., width 39 mm.; femur 49 mm.; tibia 48 mm.; foot 45 mm.; hand 27.5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	7	7	7	7	7	7
Mean	36. 7	39. 5	46. 9	50. 0	45. 4	26. 8
Standard deviation	. 79	2. 52	2. 18	1. 37	2. 09	1. 05
Variation	2. 2	6. 4	4. 7	2. 7	4. 6	3. 9
Standard error	. 30	. 95	. 83	. 56	. 79	. 40
Range	35. 2– 37. 8	37. 2– 45. 2	42. 0– 49. 0	48. 0– 52. 1	42. 6– 49. 0	25. 2– 28. 1

Color in alcohol.—Dorsum uniform deep clove brown; venter heavily mottled all over with clove brown and cream color. Lower surfaces of hands and feet as well as femur uniform brown.

Remarks.—This frog stays among rocks close to rapid streams and is extremely wary and difficult to catch. The largest tadpole at hand, USNM 96455 from Teresópolis, is about 53 mm. from snout to vent.

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96763–4, A. Lutz, 1931–4. Petrópolis, USNM 96416, 96424–6, Venancio, Dec. 20, 1926. Teresópolis, USNM 81149, 96455–6 (tadpoles), 1929–30; ZMB 29493, Miranda-Ribeiro; BM 93.12.22.4–5, Goeldi.

São Paulo: Alto da Serra, MRHN IG Reg. 75 (type of *Elosia massarti*), Massart, September 1922. Boracea, DZSP 2348, Bokermann, Mar. 10, 1948.

Genus *Odontophrynus* Reinhardt and Lütken

1862. *Odontophrynus* REINHARDT and LÜTKEN, p. 159. (Genotype, *Odontophrynus cultripes* Reinhardt and Lütken.)

Generic diagnosis.—Habit like that of *Bufo* or *Ceratophrys*. Body thick; limbs short; fingers free; toes half-webbed. Head broad; opening of mouth very large; tongue oval, free posteriorly and slightly indented. Maxillary and vomerine teeth present; no palatine teeth. Tympanum hidden. Skin rough; parotoid glands present.

Upon examining some specimens from Patagonia, USNM 15123–4, identified as *Bufo variegatus* (Günther), I found that they were very close indeed to *Odontophrynus*. In my opinion, *variegatus* should be considered as a third species of the latter genus. As this species does not occur within the geographic area covered here, no further discussion of it can be given.

Key to species of Odontophrynus of southeastern Brazil

a^1. Large parotoid glands present . . . . **cultripes** (p. 338)
a^2. No enlarged parotoid glands . . . . **americanus** (p. 336)

Odontophrynus americanus (Duméril and Bibron)

PLATE 31, FIGURES A, B

1841. *Pyxicephalus americanus* DUMÉRIL and BIBRON, p. 446 (type locality, Buenos Aires, Argentina).—BELL, 1843, p. 40, pl. 14, figs. 2, 2,a.—BIBRON, 1847, p. 10, pl. 14, figs. 1–4.—GÜNTHER, 1858, p. 24. —HENSEL, 1867, p. 123.—ESPADA, 1875, p. 20.
1862. *Pyxicephalus* [—], n. sp. COPE, 1862b, p. 352.
1862. *Ceratophrys americana* BOULENGER, 1882a, p. 266; 1885a, p. 195; 1886b, p. 440; 1894, p. 348.—BOETTGER, 1885, p. 30 in sep.; 1892, p. 29.—PERACCA, 1895, p. 25.—BERG, 1896, pp. 150, 167.—BAUMANN, 1912, p. 161.—NIEDEN, 1923, p. 386.—MARELLI, 1924, p. 585.—MERTENS, 1925a, p. 16; 1925b, p. 209; 1926a, p. 6, fig. 5; 1926b, p. 4.
1920. *Odontophrynus americanus* MIRANDA-RIBEIRO, 1920d, pp. 299, 304, pls. 4, 5; 1926, pp. 130, 214, pl. 17, figs. 1, 1,a; 1937a, p. 56.—SCOTT-BIRABÉN and FERNÁNDEZ-MARCINOWSKI, 1921, p. 129.—MÜLLER and HELLMICH, 1936, p. 32, fig. 33. —SCHUBART, 1939, p. 55.
1843. *Tomopterna americanus* FITZINGER, p. 32.

Description.—Adult male, USNM 123400, Bertioga, São Paulo. Vomerine teeth in two heavy, transverse, nearly contiguous series between the choanae; tongue not quite one-half the width of mouth-opening, cordiform, free posteriorly and with a deep notch; snout short and rounded when seen from above, sloping and truncate in profile, the upper jaw scarcely projecting beyond the lower; nostrils superior, slightly projecting, situated at the tip of the snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis bluntly rounded; loreal region slightly concave, sloping. Eye large and prominent, anterolateral, its diameter slightly greater than width of upper eyelid, greater than interval between nostrils. Tympanum not visible. Fingers free, not dilated, with distinct dermal fringes, first and second subequal, both longer than fourth, and reaching a little beyond base of antepenultimate phalanx of third. Tubercle on base of first finger strongly developed but not shovellike; all subarticular tubercles well developed; no very distinct axillary wing, although loose skin on sides of body conceals about half the upper arm; toes webbed at base, third and fifth subequal, reaching to base of antepenultimate phalanx of fourth; a large shovellike inner metatarsal tubercle, but no outer one; a short, heavy, bifurcate tarsal ridge forming a small "shovel" behind inner metatarsal tubercle. Body very stout, in postaxillary region about equal to the head width; when hind leg is adpressed, heel reaches only two-thirds of the way from groin to axilla; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to the body, heels just touch. Skin of upper parts heavily granular everywhere, with a semicircular glandular ridge behind the eye above the tympanic area, and a rounded smoother elevation in the region of the parotoids. Venter more finely granular, with the granules on the belly flattened and those on the throat conical. A loose fold of skin across the throat indicating the presence of a large median vocal sac.

Dimensions.—Head and body length 48 mm.; head length 16 mm.; head width 20 mm.; femur 16.5 mm.; tibia 15.5 mm.; foot 20.5 mm.; hand 13.5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	8	8	8	8	8	8
Mean	32. 4	41. 7	33. 5	32. 4	45. 3	28. 0
Standard deviation	1. 77	2. 85	2. 25	1. 08	2. 10	2. 07
Variation	5. 4	6. 8	6. 7	3. 3	4. 6	7. 4
Standard error	. 62	1. 02	. 79	. 38	. 74	. 73
Range	28. 4– 34. 2	35. 8– 45. 7	28. 4– 35. 5	31. 4– 34. 8	42. 7– 50. 0	24. 5– 30. 4

Color in alcohol.—Dorsum uniform dark seal brown; venter wood brown, with a seal brown reticulation. Upper lip with a few tawny spots. Throat black in the male.

Specimens examined

BRAZIL: MHNP 6372, Claussen.
  Santa Catarina: Ouro Verde, ZSBS (3), Löffler, Nov. 15, 1927.
  São Paulo: Bertioga, USNM 123399–400, Sawaya.
ARGENTINA: Tunuyán, USNM 64133.

BOLIVIA: Pocona, Cochabamba, USNM 93207, Steinbach.
URUGUAY: Montevideo, MRHN IG 4305 Reg. 378; USNM 65581, Felippone.

Odontophrynus cultripes Reinhardt and Lütken

PLATE 31, FIGURES C, D

1858. *Pyxicephalus americanus* GÜNTHER (part), p. 24.
1862. *Odontophrynus cultripes* REINHARDT and LÜTKEN, p. 159, pl. 3, fig. 1 (type localities, Lagôa Santa and Taboleiro Grande, Minas Gerais).—?F. MÜLLER, 1882, p. 134.—MIRANDA-RIBEIRO, 1920d, p. 304; 1926, pp. 131, 215, fig. 69, pl. 17, figs. 2, 2,b.—L. MÜLLER, 1934a, pp. 172, 174.
1863. *Pyxicephalus cultripes* COPE, p. 51.—BRAZIL and VELLARD, 1926, p. 65.
1882. *Ceratophrys cultripes* BOULENGER, 1882a, p. 226.—BAUMANN, 1912, p. 161.—NIEDEN, 1923, p. 387, fig. 298.

Description.—Adult male, USNM 97893, Bello Horizonte, Minas Gerais. Vomerine teeth in two wide, transverse, nearly contiguous series between the choanae; tongue not quite one-half the width of mouth-opening, rounded, its posterior border entirely free and with a small but deep notch; snout short and rounded when seen from above, sloping forwards in profile, the upper jaw scarcely projecting beyond the lower; nostrils superolateral, not projecting, situated at the tip of the snout, separated from each other by an interval equal to their distance from eye. Canthus rostralis very bluntly rounded; loreal region flat, sloping. Eye large and prominent, anterolateral, its diameter 1⅓ times its distance from nostril; interorbital diameter nearly equal to width of upper eyelid, equal to interval between nostrils. Tympanum not visible. Fingers free, not ridged or fringed, their tips not dilated, first, second and fourth subequal, extending to base of penultimate phalanx of third; a pronounced shovellike tubercle on base of first finger, and all subarticular tubercles well developed; an indistinct axillar wing terminating in some irregular, loose skin folds along sides of body; toes webbed at the base, not dilated, third longer than fifth, and reaching to base of antepenultimate phalanx of fourth; a large shovellike inner metatarsal tubercle, the outer one reduced to a small tubercle; a very heavy inner tarsal ridge, curving distally above the shovellike tubercle. Body very stout, in postaxillary region considerably narrower than the very wide head; when hind leg is adpressed, heel reaches slightly beyond axilla; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are bent at right angles to body, heels are widely separated. Skin of upper parts heavily granular, with two small bean-shaped glands just behind the eye, followed by a larger pear-shaped parotoid which extends to the middle of the back on a level with the axillae; a long, heavy gland on the upper part of the tibia; no supratympanic ridge; a few flat, round glands just behind the tympanic area; venter heavily granular everywhere, with some especially large glands just below the anus. A transverse fold of skin across the throat probably denotes the presence of an internal vocal sac.

Dimensions.—Head and body length 57 mm.; head length 20 mm., width 26 mm.; femur 21 mm.; tibia 20.5 mm.; foot 24 mm.; hand 16.5 mm.

Mathematical analysis (in percentage of total length):

	head length	head width	femur	tibia	foot	hand
Number	15	15	15	15	15	15
Mean	32. 8	45. 0	36. 1	34. 4	42. 2	27. 5
Standard deviation	1. 96	2. 45	2. 09	2. 11	2. 40	1. 60
Variation	6. 0	5. 4	5. 8	6. 1	5. 7	5. 8
Standard error	. 51	. 63	. 54	. 55	. 62	. 41
Range	29. 4– 35. 8	39. 5– 49. 1	33. 3– 39. 4	31. 8– 38. 9	38. 5– 47. 5	25. 0– 31. 1

Color in alcohol.—Dorsum seal brown, with a short middorsal white line on the sacrum, an irregular white stripe on the sides from behind the tympanic area nearly to groin, and a white bar from eye to posterior angle of mouth; a tawny interocular bar, and two indistinct, light, wide blotches on the upper lip, one below and the other in front of the eye; legs and arms with irregular light and dark crossbars, becoming less distinct proximally; venter olive-buff, the throat of the male black; palms of hands and feet sepia, with the tips of the toes and fingers as well as their tubercles pale. The female has practically the same coloration except that the throat is olive-buff like the rest of the lower surface.

Remarks.—The voice of the male is a musical, high-pitched, metallic *coo-coo* twice repeated. Two adults were taken during copulation after dark on March 13, 1935, in wet, marshy ground below a reservoir at the Country Club, near Bello Horizonte, in the vicinity of the type locality. The female deposited a gelatinous mass of eggs the next day, each egg yolk measuring about 2 mm. in diameter. A metamorphosing froglet with well-developed legs and a 5-mm. tail was taken the same night.

The adults live in holes in the ground, and can disappear in a moment in soft soil by the powerful action of the hind feet in burrowing.

Specimens examined

BRAZIL:

Minas Gerais: AMNH 17423, A. Lutz. Araxá, USNM 81138, A. Lutz. Barro Alto, USNM 121324–5. Bello Horizonte, USNM 96983, A. Lutz, May 1926; USNM 97984, A. Lutz, Dec. 9, 1933; USNM 97892–5, Cochran, Lisboa, and Venancio, Mar. 13, 1935; ZSBS 62/1924, A. Lutz, 1923. Congonhas, ZSBS 36/35, May 1935. Tres Pontes, IB 556. Vicente Carvalhaes, IB 102.

Rio de Janeiro: Alto Itatiaia, AMNH 17060.
Rio Grande do Sul: Passo Fundo, IB 87–8 and USNM 121327.
São Paulo: Butantan, USNM 121326 and IB 3. Santa Silvéria, IB 558.

Genus *Phrynanodus* Ahl

1933. *Phrynanodus* Ahl, p. 29. (Genotype, *Phrynanodus nanus* Ahl.)

Generic diagnosis.—Pupil horizontal. Tongue pear-shaped, free and entire posteriorly. Upper and lower jaw not toothed; vomerine teeth lacking; no throat folds. Tympanum hidden under the skin. No intercalated disks between the terminal phalanges of fingers and toes; all phalanges free of webs; fingers without, toes with small disks; lateral metatarsals united strongly. Shoulder girdle arciferous; omosternum and sternum cartilaginous. Sacral diapophyses not broadened.

Phrynanodus nanus Ahl

Plate 31, Figure e

1933. *Phrynanodus nanus* Ahl, p. 29 (type locality, Itatiaia, [State of Rio de Janeiro,] at 1,000 to 2,000 meters elevation).

Description.—There follows a free translation of the original description:

> Body form rather stout. Vomerine teeth lacking. Choanae very small, lying close by the border of the jaw. Tongue rather large, pear-shaped, free and entire posteriorly, without papillae. Head rather large, longer than broad; snout pointed when seen from above and in profile, projecting over the mouth opening, as long as the rather large eye, equal to the distance between the upper eyelids anteriorly, longer than high; canthus rostralis rounded but distinctly curved; loreal region descending perpendicularly, concave; nostril somewhat projecting, nearer to tip of snout than to eye; distance between nostrils less than interorbital diameter, which is twice the width of the upper eyelid; tympanum entirely hidden under the skin. Fingers short, free, first shorter than second, which is shorter than fourth; no disks; no rudiment of a pollex; subarticular tubercles distinct; palm of hand set with tubercles. Toes rather long, free of webs; disks very small but distinct, lancet-shaped, pointed anteriorly, third a little longer than fifth; lateral metatarsals strongly united; lateral toes without a skinfold; tarsal fold lacking; a small, rather long median and a smaller, longish-oval lateral metatarsal tubercle; no tarsal tubercles. Sole of foot smooth; subarticular tubercles small but distinct. When hind leg is adpressed, heel reaches between eye and tip of snout; femur shorter than tibia, which is three times as long as broad, contained a little less than twice in the body length, and much longer than foot. When legs are placed at right angles to the body, the heels cover each other. Upper parts of head, body, and limbs thickly set with small granules and tubercles, which in the region of the nape of the neck run together in two concave curved strips, and on the sides of the back run into the dorsolateral folds; upper part of tibia with diagonal strips formed of uniting tubercles. Throat and breast smooth; belly very faintly granulated; underside of femur coarsely granulated. Color in alcohol: Very dark grayish-brown, becoming still darker on the head, almost black on the snout. Limbs with indistinct light diagonal

bars. Underside dirty white, dusted with fine gray dots, darkest on the throat, breast and femur.

Head and body length: 14 mm.

Remarks.—In his introduction, Ahl states that his new genus in many respects suggests *Eleutherodactylus*, from which it is set apart by the entire lack of teeth. In the entirely toothless genera of the family, it stands next to *Batrachophrynus* Peters, being distinguished from it by the web of the hind foot. This web is present in *Batrachophrynus*, absent in *Phrynanodus*.

When I examined the type and unique example of *Phrynanodus nanus* in 1938, I noted its likeness to *Eleutherodactylus parvus* in having a similar triangular black anal patch (not mentioned by Ahl) and pointed toes. The back of *nanus* was much more tubercular than in *parvus*, however, and definite dorsolateral folds are lacking in the latter. More material is needed from the type locality to see whether the absence of vomerine teeth is indeed a permanent condition in *nanus*.

Specimen examined

BRAZIL:

Rio de Janeiro: Itatiaia, south slope at 1,000 to 2,000 meters, NHMW (type of *P. nanus*), Zerney, 1927.

Genus *Physalaemus* Fitzinger

1824. *Bufo* Spix (part), p. 47.
1826. *Physalaemus* (not *Physalaemus* Fitzinger, 1843) Fitzinger, pp. 39, 65. (Genotype *Physalaemus cuvieri* Fitzinger = *Liuperus albonotatus* Steindachner.)
1830. *Paludicola* Wagler, 1830a, p. 206.
1862. *Rhinoderma* Reinhardt and Lütken, p. 171.
1862. *Gomphobates* Reinhardt and Lütken, pp. 171–2.
1864. *Eupemphix* Steindachner, 1864a, p. 271 (part).
1864. *Nattereria* Steindachner, 1864a, p. 279.
1868. *Lystris* Cope (part), p. 312.
1875. *Pleurodema* Espada, p. 87.

Generic diagnosis.—Pupil horizontal. Tongue elliptical, entire and free between the choanae. Fingers free; toes free or very slightly webbed, often fringed; tips of digits not dilated. Outer metatarsals united. Vomerine bone with a backwardly directed process; quadratojugal present, forming a suture with the maxillary; omosternum cartilaginous; sternum with a bony style which is often furcate posteriorly; sacral diapophyses slightly dilated; terminal phalanges simple.

In Miranda-Ribeiro's original description of *Engystomops*, spelled *Eugystomops, moreirae* (1937d, p. 68; type locality, Sorocaba, São Paulo), no mention is made of the occurrence of vomerine teeth. A tarsal tubercle and a prominent inguinal gland are present, however, so that Miranda-Ribeiro's species is certainly a *Physalaemus*. Since no figure of the type has been published, and since the characters given in the original description are insufficient to give it a definite place in the synonymy of the known species of *Physalaemus*, the question of its true identity must remain unsettled for the time being.

For a statistical analysis of measurements of the species of *Physalaemus* here discussed, see pages 373 and 385.

Key to the species of Physalaemus of southeastern Brazil

a.[1] Vomerine teeth present, although rather weakly developed; venter buff, with scattered dark blotches anteriorly on belly and chest (and throat of female). . . . . **cuvieri** (p. 342)
a.[2] No vomerine teeth.
  b.[1] A tarsal tubercle present.
    c.[1] Two shovel-shaped metatarsal tubercles present, nearly equal in size; heel reaching front of shoulder . . . . . . **fuscomaculatus** (p. 345)
    c.[2] Metatarsal tubercles not shovel-shaped, the inner one much larger than the outer; heel reaching center of eye; a black lumbar gland usually present, which is covered when hind limbs are folded; venter immaculate cream . . . . **gracilis** (p. 348)
  b.[2] No tarsal tubercle.
    c.[1] A lumbar ocellus; a fold along tarsus; metatarsus with four rows of small tubercles . . . . **signiferus** (p. 351)
    c.[2] No lumbar ocellus; no tarsal fold, or only a trace of one; metatarsus smooth . . . . **olfersi** (p. 350)

Physalaemus cuvieri Fitzinger

PLATE 31, FIGURES F, G

1826. *Physalaemus cuvieri* FITZINGER, p. 65 (type locality, Brazil).—PARKER, 1927b, p. 461 (part); 1940, p. 203.—MÜLLER and HELLMICH, 1936, p. 54, fig. 19.
1862. *Gomphobates notatus* REINHARDT and LÜTKEN, p. 173, pl. 4, fig. 3, 3,a (type locality, Lagôa Santa, Minas Gerais).—STEINDACHNER, 1867, p. 11.—F. MÜLLER, 1882, p. 132.—BRANDES and SCHOENICHEN, 1901, pp. 403, 411.
1862. *Gomphobates kröyeri* REINHARDT and LÜTKEN, p. 17 (type locality, Cachoeira on Rio Paraguaçu, 18 miles from Bahia).—STEINDACHNER, 1867, p. 11.
1864. *Leiuperus albonotatus* STEINDACHNER, 1864a, p. 275, pl. 16, figs. 4–4,c (type localities, Pará, and Caiçara, Mato Grosso).—BOETTGER, 1881, p. 133.
1864. *Leiuperus ephippifer* STEINDACHNER, 1864a, p. 277, pl. 14, figs. 1, 1,a, 1,e, pl. 16, fig. 5 (type localities, Pará and Caiçara); 1864b, p. 551.
1873. *Paludicola notata* PETERS, 1873a, p. 223.
1882. *Paludicola biligonigera* BOULENGER, 1882a, (part), p. 234.—BAUMAN, 1912, p. 162.
1882. *Paludicola kroyeri* BOULENGER, 1882a, p. 235.—COPE, 1887, p. 48.—BAUMAN, 1912, p. 162.
1887. *Paludicola albifrons* BOULENGER, (part), p. 295.

1891. *Paludicola signifera* (not of Girard) Boulenger, 1891b (part), p. 454; 1898c, p. 126.—Boettger, 1892, p. 30.—Peracca, 1895, p. 16.—Berg, 1896, pp. 150, 173.—Budgett, 1899, pp. 305, 310.—Méhely, 1904, p. 211, pl. 13, fig. 6.—L. Müller, 1922, p. 171; 1927, p. 282.—Nieden, 1923, p. 505, fig. 345.—Miranda-Ribeiro, 1926, p. 160, fig. 89.—Brazil and Vellard, 1926, p. 43.—Carvalho, 1939a, p. 280.—Estable, 1942, p. 59, pl. 1, fig. 4.
1894. *Paludicola gracilis* (not of Boulenger, 1883) Boulenger, p. 348.
1912. *Paludicola signifer* (not of Girard) Bauman, p. 162.
1927. *Paludicola neglecta* Ahl, 1927b, p. 224 (type locality, ?Santa Cruz, Uruguay).

Description.—Adult male, USNM 129186, São Paulo, São Paulo. Vomerine teeth weakly developed, visible as a pair of short swollen areas just inside the internal nares, and easily felt with a sharp-pointed instrument; tongue small, less than one-half the width of mouth opening, oval, its free posterior border not indented; snout rather short, rounded when seen from above and in profile, the upper jaw projecting considerably beyond lower; nostrils superolateral, their distance from end of snout three-fourths their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis prominent, rounded, the loreal region flat, sloping outwards. Eye moderate, fairly prominent, its diameter about five-sixths its distance from tip of snout; interorbital diameter slightly less than that of upper eyelid, equal to interval between nostrils. Tympanum visible but not distinct. Fingers moderately long, free, ridged laterally, not enlarged at the tips, first, second, and fourth subequal; metacarpal tubercles rather small; subarticular tubercles of hands and feet very pronounced; no antebrachial tubercle; toes free, ridged, without enlarged disks, third much longer than fifth, extending half way on antepenultimate phalanx of fourth; metatarsal tubercles small, conical, sharp, the inner slightly the larger; a small tarsal tubercle halfway between inner metatarsal and heel, separated from the inner by a greater distance than that which separates the two metatarsals; a rather small, flat inguinal gland. Body fairly elongate, in postaxillary region equal to head width; when hind legs are adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are placed at right angles to the body, heels overlap. Skin of upper parts glandular, with a pair of elongate glandular lines from posterior eyelid down the center of back, and a shorter dorsolateral pair; a heavy diagonal fold above tympanic area; venter pustular, the area below anus and on posterior and ventral surface of femur coarsely granular; a large ventral disk from between the arms to level of groin. A very heavy vocal sac extending from below tympanum entirely across throat, with "pleats" in the middle when sac is deflated. Dark thumb patches are also present during the breeding season.

Dimensions.—Head and body 28.5 mm.; head length 9 mm., width, 9.5 mm.; femur 12 mm.; tibia 13.5 mm., foot 14 mm.; hand 8 mm

Color in alcohol.—Dorsum mouse gray with two dark, slate-colored, parallel lines from center of eyelid to coccyx; outside these on each side is a shorter diagonal stripe from midbody to groin; a dark brown line from tip of snout along canthus to eye, widening behind eye and continuing downwards and backwards above the axilla, ending halfway to groin; four vertical, dark brown, squarish spots on upper lip, the spaces between them pale gray; five alternately wide and narrow brown crossbars on upper parts of foot, tibia, and femur; a paler bar along upper arm surface; venter olive-buff, with scattered dark spots across anterior part of belly and chest; outer half of foot and hand suffused with dark; posterior femur drab-gray, immaculate except for a pair of small white patches marking glands below the anus. Vocal sac clove brown to slate color.

Variations.—Over a hundred individuals of this species were collected in a pit beneath a railroad track in the town of Pirapora, about 300 km. north of Lagôa Santa, and Bello Horizonte, the type locality of *Gomphobates notatus* Reinhardt and Lütken, now admittedly synonymized with *cuvieri.* In this fine series almost every kind of dorsal pattern may be found, from the marbled circular markings figured by Reinhardt and Lütken and suggesting those of *Physalaemus fuscomaculatus* to a linear pattern of fine, dark-edged, wavy stripes often emphasized by longitudinal glands.

A wide dark stripe, fairly regular above but with its lower border very irregular, begins at the tip of the snout in most of these specimens of *cuvieri,* widens on the loreal region, becomes still wider behind the ear, and extends along the sides more than halfway to the groin, where a diagonal lighter fork of the dorsal pattern diverts it towards the ventral region.

Three Bolivian specimens of *cuvieri* received from the Museum of Zoology of the University of Michigan agree well with some from the Pirapora series. The great diversity of pattern occurs also in Bolivian specimens, since two of them have a linear pattern of stripes and the third a circular marbling of the dorsum.

A large series of 50 well-preserved specimens from São Paulo shows similar diversity in pattern. In some of these the vomerine teeth are quite apparent; in others they are hardly to be perceived.

Males of the species have large crescent-shaped external vocal pouches extending laterally from ear to ear and lying in)(-shaped folds on the throat when not inflated, suggesting those of *Hyla raddiana* in shape.

Specimens examined

BRAZIL:

Bahia: Bahia, MP 2046. Cachoeira da Velha, Rio Novo, CM 2485, Haseman, Feb. 4, 1908.

Minas Gerais: Agua Limpa, Ouro Prêto, USNM 96998, Venancio, June 10, 1922. Bello Horizonte, USNM 96981, A. Lutz, Dec. 12, 1923. Lagôa de Retiro de Paulo Elias, near Lassance, USNM 98800, Dias, Apr. 2, 1935. Lagôa Santa, UZMK 24, 66–7, Warming. Passa Quatro, USNM 96921, A. Lutz, Mar. 9, 1923. Pirapora, USNM 98282–388, Cochran, Dias, and Venancio, Mar. 22–3, 1935. Pôrto do Fulgencio, near Lassance, USNM 98168–70, Cochran, Dias, and Venancio, Mar. 24, 1935. Rio Pandeiro, IB 276; USNM 121306.

Rio de Janeiro: Campo Bello, Itatiaia, USNM 96946, A. Lutz, Nov. 23, 1923; USNM 96947, Zikan, Dec. 28, 1923. Caxias, USNM 96221, Pinto, July 23, 1923.

São Paulo: Alto da Serra, MRHN IG 9404 Reg. 51, 52, 52b, Massart, 1922. Butantan, USNM 96871–88, Fischer, 1922–3; USNM 97771, Travassos, Apr. 30, 1935; IB 187–8; IB 596, September 1916. Capital, IB 12. Emas, DZSP 2176, 2239–41, 2245, USNM 129188, Vanzolini and Bokermann, 1946–7. Pinheiros, USNM 96892–3, A. Lutz. Poá, IB 113–7. Ribeirão Pires, ZSBS 3 (14), Bresslau, November 1913. São Paulo, MHNP 50-255 (6), Bokermann; DZSP 2548–97, USNM 129178–87, Bokermann, Sept. 29, 1947; USNM 96559–60, A. Lutz, 1922. Terceira Repressa, ZSBS (31), Schindler, Dec. 26–31, 1937.

BOLIVIA: Buena Vista, USNM 93212–4, Steinbach.

PARAGUAY: Puerto Bertoni, USNM 66665, Bertoni. Sapucai, USNM 32668, Foster.

Physalaemus fuscomaculatus (Steindachner)

Plate 31, Figures h–j

1861. *Leiuperus marmoratus* (not of Duméril and Bibron) Burmeister, p. 532.

1862. *Gomphobates marmoratus* (not of Duméril and Bibron) Reinhardt and Lütken, p. 175.—Hensel, 1867, p. 137.—Steindachner, 1867, p. 12.

1863. *Eupemphix nattereri* Steindachner (part), p. 189, pl. 1, figs. 6–9; 1864a, p. 271; 1864b, p. 552; 1867, p. 37.—Boulenger, 1882a, p. 233; 1886a, p. 413; 1903a, p. 69.—Méhely, 1904, p. 216, pl. 13, figs. 8, 9.—Baumann, 1912, p. 162.—Nieden, 1923, p. 163, fig. 214.—Miranda-Ribeiro, 1926, p. 154, fig. 85.—Müller and Hellmich, 1936, p. 22, fig. 7.—Carvalho, 1939a, p. 279.—Travassos and Freitas, 1942, p. 283.

1864. *Eupemphix fuscomaculatus* Steindachner, 1864a, p. 272, pl. 13, figs. 3–3,c (type locality, Caiçara, near São Luiz de Cáceres, Mato Grosso).

1867. *Gomphobates fuscomaculata* Steindachner, p. 12.

1868. *Lystris fuscomaculata* Cope, 1868b, p. 312.

1875. *Pleurodema granulosum* Espada, p. 95, pl. 1, fig. 6, 6,a (type locality, Montevideo).

1882. *Paludicola fuscomaculata* Boulenger, 1882a, p. 233; 1885b, p. 88; 1886b, p. 440; 1887, p. 296; 1889, p. 246; 1894, p. 348.—F. Müller, 1884, p. 281.—Boettger, 1885, p. 243.—Berg, 1896, p. 172. —Budgett, 1899, pp. 305, 309.—Peracca, 1895, p. 25; 1897, p. 16—Gadow, 1901, p. 220, fig. 45.—Brandes and Schoenichen, 1901, p. 433.—Méhely, 1904,

p. 214, pl. 13, fig. 7.—Andersson, 1906, p. 6.—Bles, 1907, p. 445, pl. 22, pl. 26, fig. 22.—Baumann, 1912, pp. 143, 145, 146, 152, 162.—Fernández, 1921, p. 114, pl. 1, figs. 2, 3, pl. 2, fig. 2, pl. 3. fig. 18.—Nieden, 1923, p. 504.—Marelli, 1924, p. 585; 1931, p. 199.—Noble, 1925, p. 2.—Miranda-Ribeiro, 1926, p. 199, fig. 88.—Mertens, 1926b, p. 1, fig. 2.—Bonjour, 1930, p. 31 in sep.—Mello-Leitão, 1937, pp. 315, 343.—Carvalho, 1939a, p. 280.—Travassos and Freitas, 1942, p. 283.

1882. *Paludicola albifrons* Boulenger, 1882a (part), p. 234; 1887, p. 295.—?Schnee, 1900, p. 464.—?Fernández, 1921, p. 115.—?Nieden, 1923, p. 503.—?de Witte, 1930a, p. 224.
1887. *Paludicola nattereri* Cope, p. 48.
1927. *Physalaemus fuscomaculata* Parker, 1927b, p. 459.—Müller and Hellmich, 1936, p. 56, fig. 20.
1937. *Eupomphyx* (sic) *nattereri* Mello-Leitão, p. 315.
1937. *Physolaemus* (sic) *fuscomaculatus* Krieg and Forster, pp. 11–12, fig. 4.
1949. *Physalarmus* (sic) *fuscomaculatus* B. Lutz, 1949a, p. 5.

Description.—Adult male, USNM 98275, Pirapora, Minas Gerais. Vomerine teeth absent; tongue extremely small, about one-third the width of mouth-opening, oval, its free posterior border not indented; snout short and broad, bluntly rounded when seen from above and in profile, the upper jaw projecting only slightly beyond the lower; nostrils superior, their distance from end of snout about two-fifths their distance from eye, separated from each other by an interval equal to their distance from eye. Canthus rostralis not evident, the entire region bluntly rounded, with only a small diagonal furrow behind the nostril marking the loreal region. Eye moderate in size, fairly prominent, its diameter about equal to that of the short snout; interorbital diameter equal to that of upper eyelid, equal to interval between the nostrils. Tympanum not visible. Fingers moderately long, free, ridged but not fringed, not enlarged into disks, second a little longer than first and equal to fourth; metacarpal tubercles large and well developed; subarticular tubercles of hands and feet very pronounced; a row of two or three very indistinct antebrachial tubercles; toes free, with narrow but very distinct lateral fringes, without disks, third much longer than fifth, reaching nearly to base of penultimate phalanx of fourth; a pair of very pronounced shovellike metatarsal tubercles nearly equal in size; a small but sharp tarsal tubercle but no heel tubercle; a large flattened inguinal gland, its greatest diameter about twice that of eye. Body stout and toadlike, in postaxillary region wider than greatest width of head, which occurs behind the tympanic area; when hind legs are adpressed, heel reaches to front of shoulder; when limbs are laid along the body, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels just fail to meet. Skin of upper parts everywhere finely glandular, with numerous low flat tubercles on back and between eyes, a nearly vertical fold from the posterior corner of eye across tympanic region nearly to shoulder; ventral surfaces smooth except for the minutely granular postanal region extending onto most of the posterior femur; a distinct large ventral disk surrounded by a large skinfold coming from the armpits and crossing the belly a little distance in front of the groin. Apparently a slight external vocal sac extending across the throat.

Dimensions.—Head and body 32.5 mm.; head length 9.5 mm., width 12 mm.; femur 13.5 mm.; tibia 13 mm.; foot 15 mm.; hand 9 mm.

Color in alcohol.—Dorsal ground color pale olive-gray; a marbled pattern of slate-gray, black-edged, sinuous, irregular spots rather evenly distributed over the entire dorsal surface, a V-shaped darker mark between the eyes only slightly emphasized; a darker horseshoe-shaped marking on anterior part of back, and a diagonal, irregular posterolateral spot partly covering the inguinal gland; many other irregular smaller or larger spots between and around these; upper surface of legs and feet with black-edged, gray, elliptical, diagonal crossbars, the middle one on the tibia considerably widened; fore limbs with irregular slate-gray marblings; upper lip with three or four squarish gray spots separated by light spaces; the postocular region covered with an irregular slate-gray area, but without any trace of a definite lateral stripe; ventral surfaces pale olive-buff, immaculate except for a few small gray spots across the throat and along the edge of the lower jaw; tips of toes, first finger, and metacarpal tubercles seal brown, the cutting edge of the metatarsal tubercles black.

Variations.—The pattern is remarkably constant, considering the fact that highly marbled designs seem to vary more than linear or other patterns. The interorbital bar appears more prominent in the specimens where the spots are less crowded towards the head region. The most prominent dorsal marking, horseshoe-shaped or Ω-shaped at times, is invariably present in the specimens at hand, and in several of them the center area of this spot is lighter than the surrounding ground color. The postocular region may be covered with a patch of fairly uniform gray color, or by some darker more or less vertical vermiculations, but never by a longitudinal dark stripe. The inguinal disk, very large in all the specimens (projecting in a ridge from the surrounding skin in one individual hardened too much in strong alcohol), is not set off by any special marking at all, but may be striped or spotted as the vermiculations extend over it from the surrounding area. The throat appears nearly immaculate in most of the specimens; in only two or three are there suggestions of gray spots as in the described specimen.

The hind legs are short in all, the adpressed heel never extending further than where the posterior tympanic border would have appeared. The tympanum is not suggested even in the hardened specimen, the diagonal fold seeming to cross the normal region of the tympanum. The fingers show a slight lateral ridge, more definite in some than in others, while the fringe on the toes is rather prominent proximally in most specimens. No vomerine teeth can be found, although the bony projection on which they would have arisen can be felt and in a few cases seen between the choanae. The ventral disk is quite evident in most of the specimens, although apparently it had no adhesive qualities. The smallest individual measures 19 mm. and is well past the tadpole stage.

Specimens examined

BRAZIL:

MINAS GERAIS: UZMK 23, Lund, Mar. 4, 1841. Lagôa do Curralinho, near Lassance, USNM 98146–9, Cochran, Dias, and Venancio, Mar. 21, 1935. Lagôa Santa, UZMK 22 (type of *Gomphobates marmoratus*), Reinhardt. Pirapora, USNM 98272–81, Cochran, Dias, and Venancio, Mar. 22–3, 1935. Rio Pandeiro, IB 274.

RIO GRANDE DO SUL: Pôrto Alegre, USNM 97183, Gliesch, 1923; ZMB 6800, Hensel.

SÃO PAULO: Emas, USNM 129189, Vanzolini and Bokermann, Dec. 26–31, 1947.

ARGENTINA: Santa Fé, USNM 97229, 1920.

BOLIVIA: Buena Vista, USNM 93215–7, Steinbach.

PARAGUAY: Chaco, USNM 69875.

Physalaemus gracilis (Boulenger)

PLATE 32, FIGURES A, B

1867. *Gomphobates notatus* (not of Reinhardt and Lütken) HENSEL, p. 138.

1883. *Paludicola gracilis* BOULENGER, p. 17 (type locality, Rio Grande do Sul); 1885a, p. 195, 1886a, p. 413; 1886b, p. 441.—BOETTGER, 1885, p. 244; 1892, p. 30.—PERACCA, 1895, p. 25.—BERG, 1896, pp. 150, 177.—BRANDES and SCHOENICHEN, 1901, p. 403.—BAUMANN, 1912, p. 162.—NIEDEN, 1923, p. 506.—MARELLI, 1924, p. 585.—MERTENS, 1925a, p. 16; 1926b, p. 4.—MIRANDA-RIBEIRO, 1926, p. 160.—EISENTRAUT, 1932, p. 317.

1885. *Paludicola ranina* COPE, 1885a, p. 186 (type locality, São João de Monte Negro, Rio Grande do Sul).

1927. *Physalaemus gracilis* PARKER, 1927b, p. 462.

Description.—Adult male, USNM 96756, Bonito, Serra da Bocaina, Rio de Janeiro. Vomerine teeth absent; tongue moderately large, about one-half the width of mouth-opening, oval, its free posterior border not indented; snout fairly elongate, rounded at the tip when seen from above and in profile, the upper jaw projecting considerably beyond the lower. Canthus rostralis rounded but fairly evident, the loreal region deeply concave. Eye moderate in size, fairly prominent, its diameter a trifle shorter than snout; interorbital diameter equal to that of upper eyelid and to that of interval between nostrils. Tympanum faintly visible on right side in this specimen, hidden on left side. Fingers moderately long, free, with faint lateral ridges, the tips ball-like but not enlarged into disks, second a little shorter than fourth and longer than first; metacarpal and subarticular tubercles well developed; no antebrachial tubercles; toes webbed at base with narrow but distinct lateral fringes, their tips rounded but not dilated, third shorter than fifth, reaching beyond the base of antepenultimate phalanx of fourth; a prominent inner metatarsal and a much smaller, rounder outer one; a small conical tarsal tubercle about midway on the inner tarsal border; a flat irregularly shaped inguinal gland. Body rather slender, in postaxillary region about equal to head width; when hind legs are adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow barely touch; when hind legs are bent at right angles to the body, heels considerably overlap. Skin of upper parts finely glandular, with a heavier row on each side of the back posteriorly; a low curving supratympanic fold ending above shoulder; ventral surfaces pustular, more coarsely so on posterior throat and abdomen; region around anus weakly granular; skin of belly very loose, forming a large ventral disk. A very heavy external vocal sac beginning behind the corners of the mouth and extending entirely across the throat.

Dimensions.—Head and body length 26 mm.; head length 8.5 mm., width 8.5 mm.; femur 11 mm.; tibia 13.5 mm.; foot 15 mm.; hand 7 mm.

Color in alcohol.—Wood brown above, slightly paler on the belly; a dark line across loreal region from nostril to eye; a dark area covering the inguinal gland.

Variations.—The Nova Teutonia specimen, USNM 103684, is slate-black above; the tympanum is black, and a down-curving black lateral stripe extends from it onto the sides, edging the heavy lateral fold below. The upper arm, posterior belly, and proximal femur are drab-gray, the belly with many black spots becoming coarser anteriorly, but with a slight median line on the chest, which the spots do not invade. The throat and chin are black, including the heavy diagonal folds of the vocal pouch that in development somewhat suggest those of *Leptodactylus sibilatrix.* The femur towards the knee becomes spotted with fine slate dots. The concealed anterior part of the femur, also the inside of the tibia, are salmon color. The upper surfaces of legs and forearms have diagonal black crossbars. A very heavy ventral disk is present in the male.

Specimens examined

BRAZIL:

Rio de Janeiro: Bonito, Serra da Bocaina, USNM 96756–8, A. Lutz, January 1925.

Rio Grande do Sul: Pôrto Alegre, USNM 97184–5, Gliesch, 1923. Estrella, northwest of Pôrto Alegre, ZSBS 197/1925, von Parseval, 1925.

Santa Catarina: Lagôa, IB 192 (4). Nova Teutonia, Itá, USNM 103684, Plaumann, January 1938.

URUGUAY: USNM 73530, Felippone. Montevideo, MRHN IG 4544, Reg. 404.

Physalaemus olfersi (Lichtenstein and Martens)

PLATE 32, FIGURES C, D

1856. *Phryniscus olfersi* LICHTENSTEIN and MARTENS, p. 40 (type locality, Brazil).

1863. *Phyllobates glandulosus* FITZINGER, *in* Steindachner, p. 53, pl. 1, figs. 1–4 (type locality, Brazil).

1864. *Nattereria lateristriga* STEINDACHNER, 1864a, p. 279, pl. 14, figs. 2–2,c (type locality, Curitiba, Paraná).—BOULENGER, 1882a, p. 273.—BAUMANN, 1912, p. 162.

1882. *Paludicola olfersi* PETERS, p. 62.—BERG, 1896, pp. 150, 176.—WANDOLLECK, 1907, p. 11, pl. 1, figs. 6–6,b.—BAUMANN, 1912, p. 162.—L. MÜLLER, 1922, p. 170.—MIRANDA-RIBERIO, 1926, p. 161, fig. 90.—LUEDERWALDT, 1929, p. 39.—CARVALHO, 1939a, p. 280.

1886. *Paludicola olfersii* BOULENGER, 1886a, p. 413; 1887, p. 297; 1888c, p. 416.—NIEDEN, 1923, p. 509.

1927. *Physalaemus olfersi* PARKER, 1927b, p. 464.

Description.—Adult male, USNM 96636, Serra da Bocaina, Rio de Janeiro. Vomerine teeth absent; tongue small, oval, about one-half the width of mouth opening, its free posterior border not indented; snout fairly elongate, rounded from above, slanting forwards in profile, the upper jaw considerably projecting beyond the lower; nostrils lateral, their distance from end of snout about one-half their distance from eye. Canthus rostralis sharp and distinct, the flat loreal region making a right angle with it. Eye moderate in size, fairly prominent, its diameter equal to two-thirds of the length of the snout; interorbital diameter 1¾ times the width of upper eyelid, slightly greater than interval between nostrils. Tympanum very faintly visible. Fingers moderately long, free, ridged on the sides, not enlarged, second longer than first and shorter than fourth; metacarpal tubercles moderately developed; subarticular tubercles of hands and feet very pronounced; no antebrachial tubercle; toes long, free, with narrow, distinct lateral ridges, not dilated at the tips, third and fifth subequal, reaching beyond base of antepenultimate phalanx of fourth toe; a small, sharply tapering inner metatarsal tubercle and a similar outer one nearly as large; no tubercle on tarsus or heel; no apparent inguinal gland. Body rather slender and elongate, in postaxillary region slightly narrower than the head width; when hind limbs are adpressed, heel reaches to center of eye; when limbs are laid along the sides, knee and elbow overlap considerably; when hind legs are bent at right angles to body, knees overlap. Skin of upper parts minutely glandular, the network of glands becoming heavier on top of head; a slight glandular swelling above tympanum but no definite ridge; venter smooth except for some glandules on the throat; posterior femur below anus weakly granular; skin of belly very loose, tending to form a large ventral disk. A heavy vocal sac extending from below corners of mouth across throat.

Dimensions.—Head and body 32.5 mm.; head length 11.5 mm., width 9.5 mm.; femur 13 mm.; tibia 15.5 mm.; foot 16.5 mm.; hand 9 mm.

Color in alcohol.—Dorsum pale wood brown; a wide, sepia, diagonal stripe beginning behind eye and extending behind arm along sides to groin, narrowing posteriorly. This sepia stripe is bordered above by a narrow, distinct white line beginning on the tip of the snout, traversing the canthus and upper eyelid, and ending at the groin; a second white line defines the lower anterior part of this sepia stripe from below eye to shoulder; faint dark crossbars on upper tibia and femur; venter dusky gray with small white dots prominent on belly and posterior femur; vocal sac dark gray, with a few white dots.

The females are quite similar in color, except that the venter is pale with a few larger dark spots on throat and chest.

Remarks.—This species is easily recognizable in a difficult group because of the absence of a tarsal tubercle and because of the presence of the very characteristic white-edged, sepia longitudinal stripe along the sides from eye halfway to groin.

Its voice is said to be a plaintive whimpering.

Specimens examined

BRAZIL: NHMW (1; type of *Phyllobates glandulosus*).

Rio de Janeiro: ZMB 5913, Garcia. Macaé, USNM 96476, Pugas, Mar. 2, 1924. Nova Friburgo, USNM 96476, Pugas, Mar. 2, 1924. Petrópolis, BM 1932.10.2.15–8. Serra da Bocaina, USNM 96634–9, A. Lutz, Jan. 2–19, 1930. Teresópolis, BM 95.3.6.2, Goeldi.

Santa Catarina: Humboldt, ZSBS 285/1920 (6), 745/20, Erhardt. Rio Humboldt, USNM 66580–1, Fritsche, November 1918; BM 1923.6.1.26–7.

***Physalaemus signiferus* (Girard)**

Plate 32, Figures e, f

1853. *Rhinoderma signifera* Girard, p. 424 (type locality, Rio de Janeiro); 1858, p. 72.

1892. *Paludicola signifera* Boettger, p. 30.—Nieden, 1923 (part), p. 505, fig. 345.—Miranda-Ribeiro, 1926 (part), p. 160, fig. 89.—Brazil and Vellard, 1926 (part), p. 43.—L. Müller, 1927, p. 282.—Carvalho, 1939a, p. 280.

1912. *Paludicola signifer* Baumann (part), p. 162.

1924. *Paludicola bresslaui* L. Müller, 1924a, p. 175 (type locality, Teresópolis, Rio de Janeiro); 1927, p. 281.
1925. *Eupemphix maculiventris* A. Lutz, 1925a, p. 138 (type locality, mountains near Santos, São Paulo); 1926a, pp. 5, 12.
1927. *Physalaemus cuvieri* (not of Fitzinger) Parker, 1927b (part), p. 461.
1929. ?*Paludicola nana* Luederwaldt, p. 39.
1946. *Eupemphix nana* (not of Boulenger) Myers, pp. 11, 29.

Description.—Adult male, USNM 96840 (cotype of *Eupemphix maculiventris*), Alto da Serra, São Paulo. Vomerine teeth absent; mouth-opening very small; snout wedge-shaped, almost like that of a microhylid; tongue one-half the diameter of mouth-opening, elongate, oval, without an indentation on its partly free posterior border; snout moderate in length, pointed at the tip when seen from above, slanting backward to the mouth-opening in profile, the upper jaw consequently projecting far beyond the lower; nostrils lateral, considerably below the canthal angle, their distance from end of snout only about one-third their distance from eye, separated from each other by an interval somewhat less than their distance from eye. Canthus rostralis sharp, the loreal region flat and forming a right angle with the top of the snout; the upper lip nearly vertical and scarcely flaring out from the loreal region. Eye rather small, fairly prominent, its diameter contained 1¾ times in the snout; interorbital diameter 1¼ times that of the upper eyelid, considerably greater than that between nostrils. Tympanum faintly visible (in this specimen), about one-half the eye diameter, separated from the eye by half its own diameter. Fingers moderate in length, free, not fringed, their tips only slightly swollen, the tips of the outer ones rather truncate, but not appearing as definite disks; first and second fingers subequal, second a little shorter than fourth, which extends to base of antepenultimate phalanx of third; toes without webs or fringes, the tips swollen but not forming disks; third slightly longer than fifth, reaching nearly to base of antepenultimate phalanx of fourth; no tubercle under the arm; subarticular tubercles of hands and feet very indistinct; a pair of small round metatarsal tubercles, the inner and outer nearly the same in size; no tarsal tubercle or ridge; a low flat inguinal gland twice the diameter of the eye in width. Body elongate, elliptical, in postaxillary region about equal to greatest width of head, which comes behind the tympanic area; when hind legs are adpressed, heel reaches to anterior corner of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to the body, heels touch. Skin of upper parts nearly smooth except for some Λ-shaped dorsal glands extending across the back; a low glandular ridge beginning behind the eye, extending straight backwards and widening to a heavy lateral fold which reaches the groin; ventral surfaces quite smooth, also the postanal region, which is usually granular in other species. Vocal sac apparently external, extending entirely across the throat.

Dimensions.—Head and body 21.5 mm.; head length 6 mm., width 6.5 mm.; femur 9.5 mm.; tibia 10.5 mm.; foot 10.5 mm.; hand 5.5 mm.

Color in alcohol.—Ground color of dorsal surface drab, becoming paler on the limbs; an indistinct interorbital crossband, bordered behind by a darker drab patch that fades out posteriorly; a large chocolate postanal patch, and a series of similar dark spots along the lower posterior side of the femur; upper part of femur with a brown diagonal crossbar, and a few parallel brown dots on each side; knee brown, a few brown spots along outer tibia, and some faint brown crossbars above; foot also barred and spotted with brown, lower surface of tarsus nearly entirely brown; forearm faintly crossbarred, a wide brown stripe along its lower surface; a faint brown line extending backward from the eye, widening on the sides as it follows the diagonal glandular line; venter olive brown anteriorly, lightening posteriorly and with some large black spots scattered over the abdomen; throat dull olive. Inguinal gland covered posteriorly by a round sepia spot; its anterior part probably red or yellow in life.

Color in life.—The coloration of specimens collected on Tijuca is as follows: Body russet, very beautifully marked with sepia patterns edged narrowly with pale cream color. Legs wood brown, with similar markings. A dark, clove-brown, lateral stripe from eye onto side of body. A cadmium-orange inguinal spot extending onto the anterior femur, and a similar but duller orange tone on upper lip and side of head past the tympanum. Throat slate color, paler on chest, abruptly changing to orange-buff on anterior part of belly; posterior belly pearl gray. Lower limb surfaces olive-gray, with the glandules tipped with orange. Metatarsal tubercles orange. Tips of toes pale olive-buff. Pupil clay color with a gold ring around the iris, which is transversely elliptic. At first glance this species suggests a *Microhyla.*

A dissection of the fourth toe in USNM 70578 from Angra dos Reis shows the terminal phalanx to be a thick cylinder proximally, then tapering and again widening at the tip although no true T-shape is attained.

Variations.—Seven additional specimens from Alto da Serra do not show much variation in essential features. The tympanum becomes partly visible only in a dried specimen, and apparently did not show at all in the living animal. The adpressed heel may reach to the center of the eye, or nearly to the nostril. The spotting on the belly is fairly fine and uniform, like that of the described specimen, in 96843; it is very coarse and scattered and the spots do not have light centers in 96841 and 96838, while the remaining four have only the belly suffused with irregular small dark areas.

Remarks.—Although *Physalaemus cuvieri* is the commonest and most widespread member of its genus in Brazil, it does not seem to occur near the city of Rio de Janeiro or in the coastal region of the State. Its place is taken by a *Physalaemus* originally described by Girard as *Rhinoderma signifera*, from Rio de Janeiro, and later by L. Müller as *Paludicola bresslaui*, from Teresópolis in the Serra das Orgãos which form a part of the coastal range. While the type of Girard's *signifera* has been lost, the original description appears to agree in every phase with Müller's description of *bresslaui*.

P. signiferus shows considerable similarity to *Eupemphix nana* Boulenger (1888a, p. 187; type locality, Lages, Santa Catarina). The snout in the cotypes of *nana* is less prominent, and maxillary teeth are lacking in that species, while in *signiferus* the snout is more prominent, and maxillary teeth are present although poorly developed. While *Eupemphix nana* can now be assigned to the genus *Physalaemus*, more specimens should be collected and studied to find out to what degree the shape of the snout varies, and whether maxillary teeth may occasionally be found.

Examples of *signiferus* were compared with the type of *Paludicola bresslaui* L. Müller, and the two were found to be identical by Dr. Müller and me.

Specimens examined

BRAZIL:

DISTRICTO FEDERAL: Covanca, MZUM 68787, A. Lutz, January 1930. Rio de Janeiro, USNM 70580, Metcalf, Oct. 10, 1925; ZSBS (3), A. Lutz, 1923. Tijuca, USNM 96310–1, A. Lutz, Cochran, and Venancio, Mar. 5, 1935; USNM 97424, 99123, A. Lutz, Cochran, and Venancio, Jan. 21, 1935; MZUM 104248 (3), Bailey, 1941. Jardim Botánico, BM 1914.3.20.5, Hill.

RIO DE JANEIRO: Angra dos Reis, USNM 70578–90, Metcalf, Oct. 13, 1925; USNM 96544–7, A. Lutz, 1924. Barro Branco, MZUM 104280 (5), Bailey, 1941. Petrópolis, BM 1932.10.2.35–6, Michaelis. Santa Anna, Serra de Friburgo, USNM 96471–4, A. Lutz, Dec. 12, 1922. Teresópolis, BM 1914.3.20.6, Hill; ZSBS 285, Bresslau, February–March 1929.

SÃO PAULO: Alto da Serra, USNM 96837–44 (cotypes of *Eupemphix maculiventris*), A. Lutz, February 1923. Boracea, MHNP 50-256, Bokermann.

Genus *Pleurodema* Tschudi

1838. *Pleurodema* TSCHUDI, p. 84, (Genotype *Pleurodema bibroni* Tschudi.)

Generic diagonsis.—Pupil horizontal. Tongue subcircular or oval, free and entire, or slightly nicked posteriorly. Vomerine teeth present or absent; when present, between the choanae. Fingers free; toes webbed or free, often fringed; tips of digits not dilated. Outer metatarsals united. Vomerine bone with a backwardly directed process; quadratojugal reduced or absent, not reaching the maxillary;

omosternum cartilaginous, sternum with a bony style which is usually single, sometimes furcate posteriorly; sacral diapophyses slightly dilated; terminal phalanges simple.

Pleurodema verrucosa (Reinhardt and Lütken)

1862. *Leiuperus verrucosus* REINHARDT and LÜTKEN, p. 171 (type locality, near Juiz de Fóra, Minas Gerais).
1882. *Paludicola verrucosa* BOULENGER, 1882a, p. 171.—BAUMANN, 1912, pp. 133, 151.—NIEDEN, 1923, p. 507.—MIRANDA-RIBEIRO, 1926, pp. 164, 223.
1927. *Pleurodema verrucosa* PARKER, 1927b, p. 476.

When I examined the type of this species in Copenhagen in 1938, I made the following notes: "Specimen immature. It does not seem to be a *Pleurodema* or a *Physalaemus*, but resembles *Eleutherodactylus guentheri* more closely, excepting for a few heavy warts in transversely serrate formation on the back. Heel reaching to tip of snout. Toes and fingers long, unwebbed, with a very slight disk at the tips. No tubercle in center of tarsus. Two well-marked metatarsal tubercles present. No vomerine teeth. Upper lip with coarse light and dark spots as in young *Leptodactylus typhonius*. Head and body 22 mm."

Parker (1927b, p. 476) does not state whether he actually examined this type when he translated its original description and listed it as a valid species in his revision of the genus. Until further collecting can be done at the type locality, the status of this form must remain questionable.

Specimen examined

BRAZIL:

MINAS GERAIS: Near Juiz de Fóra, UZMK 51 (type of *Leiuperus verrucosus*), Reinhardt, June 1847.

Genus *Pseudopaludicola* Miranda-Ribeiro

1867. *Liuperus* HENSEL, p. 134.
1882. *Paludicola* BOULENGER, 1882a (part), p. 236.
1922. *Pleurodema* RUTHVEN (part), p. 54.
1926. *Pseudopaludicola* MIRANDA-RIBEIRO, p. 152. (Genotype, *Liuperus falcipes* Hensel.)

Generic Diagnosis.—Pupil horizontal. Tongue oval, entire, free behind. Vomerine teeth absent. Fingers free; toes slightly webbed, fringed; tips of digits simple or very slightly dilated; outer metatarsals united. Vomerine bone without backwardly directed process; quadratojugal small, not reaching the maxillary; omosternum cartilaginous; sternum elongate, cartilaginous or calcified; sacral diapophyses only very slightly dilated; terminal phalanges simple or T-shaped.

Pseudopaludicola ameghini (Cope)

Figure 27

1887. *Paludicola ameghini* Cope, p. 50 (type locality, Chapada, Mato Grosso).—Baumann, 1912, p. 162.—Nieden, 1923, p. 507.—Miranda-Ribeiro, 1926, pp. 164, 223.—Mello-Leitão, 1937, pp. 315, 342.
1927. *Pseudopaludicola ameghini* Parker, 1927b, p. 454.

Description.—Adult male, USNM 98433, Pirapora, Minas Gerais. Tongue oval, about one-half the width of mouth-opening, rounded on its free posterior border. Snout round when viewed from above and in profile; upper jaw projecting considerably beyond lower. Nostrils superolateral, midway between tip of snout and eye, the interval between them equal to their distance from eye; canthus rostralis bluntly rounded, merging into the flat, sloping loreal region, which is set off from the upper lip by a short furrow. Eye large and prominent, its diameter not quite as great as its distance from end of snout; interorbital diameter as wide as upper eyelid, equal to interval between nostrils. Tympanum not visible. Fingers moderately long, fringed, not dilated, second slightly longer than fourth, reaching to base of antepenultimate phalanx of third; a large oval metacarpal tubercle and a crescentic one at base of first finger; subarticular tubercles of hands and feet well developed; a small oval antebrachial tubercle near base of thumb, and indications of a second one at the end of a fold extending nearly to the elbow. Toes long, fringed, third longer than fifth, reaching halfway along the antepenultimate phalanx of fourth; a moderate oval inner and a small outer metatarsal tubercle; a heavy tarsal ridge beginning at the inner tubercle,

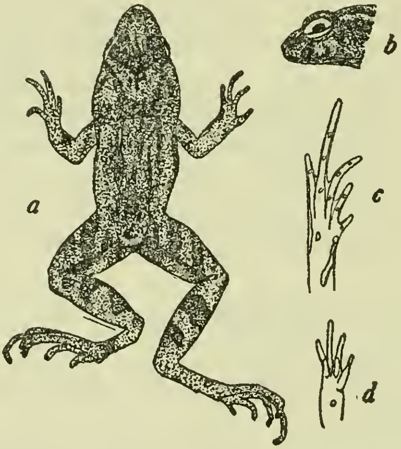


Figure 27.—*Pseudopaludicola ameghini*, USNM 98433: *a*, Dorsum; *b*, profile; *c*, foot; *d*, hand; all × 2⅜.

crossing the tarsus and ending at the heel on the outer side of foot, the central part of this ridge curving and almost shovellike; no specialized inguinal gland. Body rather slender, in postaxillary region a little narrower than head; when hind legs are adpressed, heel reaches to nostril; when limbs are laid along the sides, knee and elbow overlap; when hind limbs are bent at right angles to body, heels greatly overlap. Skin of upper parts glandular, with many short glandular ridges on the back; the most prominent of these is a pair going diagonally backwards from each eyelid towards center of back; no decided skinfold or ridge above tympanum; venter smooth except for granulations below anus and on posterior femur. A ventral disk from chest to posterior part of belly. Apparently no external vocal sac in the male.

Dimensions.—Head and body 13.5 mm.; head length 5 mm. (to angle of mouth), width 4.5 mm.; femur 6 mm.; tibia 7 mm.; foot 8 mm.; hand 3.5 mm.

Color in alcohol.—Dorsum drab; a wide V-shaped brown spot between the eyes; upper parts of legs with one or two widely spaced crossbars. Posterior femur with a light yellowish stripe bordered by dusky brown, the brown border very narrow ventrally; some white spots below the anus marking the positions of glands. Venter clay color, immaculate except for some pale brown marblings around edge of lower lip.

Variations.—In most specimens from Minas Gerais the throat and breast are uniformly pale like the belly, except for a row of small brown dots sometimes present along the borders of the lower lip. Very rarely there may be a transverse irregular row of light gray dots across the throat. The six specimens from São Paulo have the throat, chest, and belly uniformly pale also. Some specimens have a narrow white middorsal line; most of them, however, have only dark)(- or X-shaped markings between the shoulders following the usual transocular crossbar, and a /\- or ∩-shaped dark sacral mark. The snout is rounded and the nostrils are usually about midway between the eye and tip of snout, although occasionally a little closer to the latter.

A large female, USNM 97016, measures 18 mm. in total length; the males seldom exceed 15.5 mm.

Remarks.—The fact that scars of *Cercaria* are frequently found on this as well as on other partly aquatic species makes it difficult at first glance to ascertain the real character of the tubercle under the forearm. By looking at a series of frogs, however, it is possible to recognize the differences between a tubercle and a scar. A second tubercle, near the elbow, is usually a little less distinct than the one near the wrist, although sometimes both are practically indistinguishable.

Several specimens from the localities listed were compared with cotypes of *P. ameghini*, ANS 11262–3, by Dr. E. R. Dunn, who informs me that they are conspecific.

P. ameghini is extremely abundant in Minas Gerais in the short grass bordering the numerous lagôas near Bello Horizonte. The individuals are agile, jumping about a meter at a time, then crouching among the grass blades and leaping sideways in a new direction if the pursuit still continues. *P. falcipes* seems to take its place in the south. The former has a white venter, the latter a spotted one.

Specimens examined

BRAZIL:

Bahia: Alagoinhas, Rio Catu, CM 2676–9, Haseman, Mar. 4, 1908. Boqueirão, Rio Grande of the São Francisco basin, CM 2651–4, Haseman.

Ceará: Fortaleza, USNM 109152–4, von Ihering, 1936.

Minas Gerais: USNM 70558–72, Metcalf, Oct. 19, 1925. Bello Horizonte, USNM 97897–944, Cochran, Lisboa, and Venancio, Mar. 13–15, 1935; USNM 96966–71, A. Lutz, July 5, 1933. Corrego São Gonçalo das Tabocas near Lassance, USNM 98150–2, Cochran, Dias, and Venancio, Mar. 23, 1935. Lagôa do Curralinho near Lassance, USNM 97016–21, A. Lutz, 1921–2; USNM 98153–67, Cochran, Dias, and Venancio, Mar. 21, 1935. Lagôa Grande, near Morro Velho, USNM 97992–98013, Cochran, Dias, and Venancio, Mar. 16, 1935. Lagôa Secca, near Bello Horizonte, USNM 97946–77, Cochran and Venancio, Mar. 13–15, 1935. Ouro Prêto, USNM 98068–77, Cochran, Dias, and Venancio, Mar. 19, 1935. Pirapora, USNM 98389–533, Cochran, Dias, and Venancio, Mar. 22–23, 1935. Piraporinha, USNM 98549–67, Cochran, Dias, and Venancio, Mar. 23, 1935. Rio Pandeiro, IB 496–8, 519–22.

São Paulo: Rincão, USNM 96894–9, Pinto, Dec. 16, 1929.

Genus *Zachaenus* Cope

1866. *Zachaenus* Cope, p. 94. (Genotype, *Cystignathus parvulus* Girard.)
1905. *Oocormus* Boulenger, p. 181.

Generic Diagnosis.—Pupil horizontal. Tongue round, attached to a broad pedicel. Vomerine teeth in a transverse series upon palatine arch. Tympanum distinct. Fingers and toes free, the tips not dilated. Outer metatarsals united. Omosternum cartilaginous; sternum a cartilaginous plate. Terminal phalanges simple.

Zachaenus parvulus (Girard)

Plate 33, Figures a, b

1853. *Cystignathus parvulus* Girard, p. 422 (type locality, Rio de Janeiro); 1858, p. 35, pl. 3, figs. 34–38.

1866. *Zachaenus parvulus* Cope, p. 94.—Boulenger, 1882a, p. 257.—Baumann, 1912, pp. 138–9, 153, 162.—Nieden, 1923, p. 389.—Miranda-Ribeiro, 1926, p. 120.—Mello-Leitão, 1937, p. 331.—B. Lutz, 1944b, pp. 1–66, 14 pl.; 1947, p. 247; 1949a, p. 3.—Myers, 1946, pp. 11, 29.

1905. *Oocormus microps* Boulenger, p. 181 (type locality, Organ Mountains [Rio de Janeiro]).—deWitte, 1930a, p. 222.—Nieden, 1923, p. 388.—B. Lutz, 1943, p. 225, figs. 1, 2.

1926. *Ceratophrys fusciventris* A. Lutz, 1926c, p. 1012 (type locality, Tijuca, Rio de Janeiro).

1932. *Leptodactylus parvulus* A. Lutz, 1932a, p. 755.

Description.—Adult female, USNM 96313 (cotype of *Ceratophrys fusciventris*), Tijuca, city of Rio de Janeiro. Vomerine teeth in two very long, posteriorly converging, nearly contiguous series well behind the choanae; tongue three-quarters as wide as mouth-opening, round, fairly free posteriorly and slightly so anteriorly due to its attachment on a stalk (as in *Craspedoglossa*); snout very short and rounded when seen from above, somewhat truncate in profile, the upper jaw not projecting beyond the lower; nostrils lateral, slightly projecting, their distance from end of snout about two-thirds that from eye, separated from each other by an interval 1½ times as great as their distance from eye. Canthus rostralis low and rounded; loreal region concave and nearly horizontal due to the extreme flaring out of the upper lip. Eye small, anterolateral, with a large meniscus on upper border of pupil; eye diameter a little greater than its distance from nostril; interorbital diameter twice the width of upper eyelid, equal to interval between nostrils. Tympanum not visible. Fingers free, not fringed, their tips blunt, not dilated, second longer than first and equal to fourth, extending to base of penultimate phalanx of third; no pronounced pollex, but palmar and subarticular tubercles moderate; a very distinct fold of skin along the sides extending from the groin nearly to the elbow and forming an axillar wing; toes without webs, fringes, or disks, third longer than fifth, reaching to base of antepenultimate phalanx of fourth; a prominent blunt oval inner and a small rounded outer metatarsal tubercle; a very indistinct inner tarsal ridge; body quite stout, in postaxillary region a little less than the width of the very broad head; whan hind leg is adpressed, heel reaches to posterior tympanic region; when limbs are laid along the sides, knee and elbow fail to meet; when hind legs are laid at right angles to body, heels just meet. Skin of upper parts fairly smooth except for some minute glandules on top of head and tibia; a heavy semicircular fold from posterior corner of eye encircling tympanic region and ending in front of shoulder; another heavier glandular fold originating on the posterior corner of the eyelid, nearly converging between the shoulders, then abruptly diverging and continuing longitudinally nearly to the groin; ventral surface smooth excepting for a granular postanal patch. (A slight skinfold across the throat but apparently no external vocal sac in the male.)

Dimensions.—Head and body length 20.5 mm.; head length 8 mm., width 9.5 mm.; femur 9 mm.; tibia 9 mm.; foot 9 mm.; hand 4.5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	6	6	6	6	6	6
Mean	38. 2	45. 7	43. 5	44. 4	44. 6	22. 2
Standard deviation	1. 69	1. 73	. 80	2. 06	2. 24	. 49
Variation	4. 4	3. 8	1. 82	4. 6	5. 0	2. 2
Standard error	. 69	. 71	. 33	. 84	1. 00	. 22
Range	35. 1– 40. 0	42. 3– 47. 4	42. 3– 44. 8	40. 7– 47. 4	40. 7– 47. 4	21. 6– 22. 8

Color in alcohol.—This specimen is now bleached to cream buff dorsally, with traces of dark sepia below the converging parts of the glandular dorsal lines; forearm and tibia with large sepia spots; posterior femur and postanal region immaculate sepia; heel and tarsus sepia; ventral surface wood brown turning to cinnamon on throat.

Color in life.—One specimen, USNM 97427, collected on Tijuca, near Cascatinha, was a dark slate gray when first found. By the next morning it had turned much paler, and the following color notes were then made: Dorsum ochraceous-buff with patches of pale clay color edged with clove brown. Snout on top from eye forward pale greenish chrome yellow. Ventral surface clove brown with reticulations of opaque white, a vinaceous tinge between the arms on chest. Feet and hands pale greenish chrome yellow. Upper part of iris pale brassy gold, then a black hourglass-shaped horizontal mark, and a smaller area of gold below it.

Variations.—Additional examples agree well with the described specimen in proportions. The largest, USNM 96314, has the canthus even a little more rounded than in the described specimen and shows very distinctly the large meniscus over the upper part of the pupil of the eye, a structure found also in *Cycloramphus.* The heel does not reach beyond the corner of the mouth even in the immature frog. Some fine pustules on the sides are occasionally present. The color pattern seems to be fugitive on specimens preserved for some time, but the remnant that still persists compares well with that of freshly collected examples. Some narrow diagonal mottled stripes appear across the upper surface of femur and foot as well as on the tibia in fresher specimens, while a single slanting dusky spot begins above the arm, slopes rapidly down on the sides where it widens and finally loses itself in the dark ventral coloration. A Y- or M-shaped dusky marking also appears across the sacral region. The sides of the head have three slanting dark lines setting off two pale triangles below the eye, while the edge of the lips is especially darkened. The dark ventral spotting extends also onto the arms and legs, although diminished in intensity.

Remarks.—Adults are found under leaves in mountain forests near the city of Rio de Janeiro. Their small size and their apparently very local distribution have made them extremely rare in museum collections.

Dr. Bertha Lutz (1944b) has described the development and hatching of the eggs.

The shape of the tongue in *Zachaenus parvulus* is extremely suggestive of that of *Craspedoglossa stejnegeri* (Noble), the type of which is from the Serra das Orgãos, near the city of Rio de Janeiro. While the two forms are specifically distinct, owing to the larger adult size, shorter legs, more pointed snout, and absence of axillar wing in the latter, they may prove to be congeneric. The type of *Zachaenus roseus* Cope from Port Otway, Patagonia, is too completely macerated to be of any value in comparison.

Specimens examined

BRAZIL:

Districto Federal: Rio de Janeiro: Corcovado, USNM 96337, Venancio. Tijuca, USNM 96313 (cotype of *Ceratophrys fusciventris*), Venancio, Jan. 10, 1926; USNM 96314, A. Lutz, Aug. 9, 1929; USNM 96315, A. Lutz, Mar. 5, 1934; USNM 97427, A. Lutz, Cochran, and Venancio, Feb. 19, 1935; ZSBS 21/1947, A. Lutz, 1932.

Rio de Janeiro: Serra das Orgãos, BM 1901.11.25.7 (type of *Oocormus microps*), Wagner brothers.

Suborder DIPLASIOCOELA

Family Microhylidae

Fimisternal Salientia, with a tongue. Eustachian tubes, if present, paired. No ribs. No intercalary phalanges. Vertebral column procoelous or diplasiocoelous. Sacral diapophyses more or less dilated. Ethmoid divided or absent. Palatal folds usually present. *Coraco-radialis* attached to the whole width of the precoracoid-clavicular bar when this is present. Insertion of the *semitendinosus* passing dorsal to the *gracilis*. Larva without horny mandibles, labial teeth, or suprarostral cartilage; spiraculum, if present, median.

Key to the genera of Microhylidae of southeastern Brazil

a^1. Clavicles and precoracoids present.
  b^1. Clavicle and precoracoid well developed, both extending from the midline of the sternum to the scapula.
    c^1. Clavicle strongly bent, forming almost a right angle proximally with the scapula; omosternum absent; sternum wide, cartilagionus; tympanum indistinct . . . . **Stereocyclops** (p. 370)

c^2. Clavicle straight or but slightly bent . . . . **Hypopachus** (p. 366)

b^2. Clavicle much reduced, not reaching the scapula and confined to the mesial portion of the precoracoid.

c^1. Precoracoid and clavicle usually reaching the distal half of the coracoid. **Chiasmocleis** (p. 362)

c^2. Precoracoid and clavicle very small, not reaching the distal half of the coracoid . . . . **Elachistocleis** (p. 364)

a^2. Clavicles and precoracoids absent . . . . **Microhyla** (p. 368)

Genus *Chiasmocleis* Méhely

1885. *Engystoma* (not of Fitzinger) BOETTGER (part), p. 240.
1904. *Chiasmocleis* MÉHELY, p. 210 (genotype, *Engystoma albopunctatum* Boettger).
1910. *Gastrophryne* STEJNEGER (part), p. 166.
1924. *Nectodactylus* MIRANDA-RIBEIRO, 1924b, p. 256; 1926, p. 182.

Generic diagnosis.—Prevomer divided, the postchoanal portion wanting, palatine absent. Clavicle and precoracoid present, short, reaching the midline of the girdle but not the scapula, as they meet the coracoid in its lateral half; no omosternum; sternum cartilaginous. Vertebral column diplasiocoelous. Terminal phalanges simple. Pupil round. Tongue oval, entire, and free behind; two smooth dermal ridges across the palate, in front of the pharynx, the anterior much shorter than the posterior. Digits without terminal disks, or with very small ones. Tympanum hidden; first finger much shorter than second; outer toe shorter than third; outer metatarsal tubercle lacking.

Key to species of Chiasmocleis of southeastern Brazil

a^1. Canthus rostralis rounded . . . . **albopunctata** (p. 362)

a^2. Canthus rostralis well marked, angular . . . . **bicegoi** (p. 363)

Chiasmocleis albopunctata (Boettger)

FIGURE 28

1885. *Engystoma albopunctatum* BOETTGER, p. 240 (type locality, Paraguay).—BOULENGER, 1894, p. 347.—BUDGETT, 1899, pp. 305, 311.—PERACCA, 1904a, p. 12.—MIRANDA-RIBEIRO, 1920c, p. 282; 1926, pp. 185, 225.
1904. *Chiasmocleis albopunctata* MÉHELY, p. 210, pl. 13, figs. 4, 5.—PARKER, 1934a, p. 118.—DUNN, 1949, p. 8.
1910. *Gastrophryne albopunctata* STEJNEGER, p. 166.

Description.—Adult female (?), IB 455, Canna Brava, Goiás. Snout rounded, rather prominent, 1½ times as long as the eye; canthus rostralis rounded; loreal region oblique, not concave; nostril much nearer to the tip of the snout than to the eye; interorbital space three times as broad as the upper eyelid. Fingers not dilated, short, bulbous at the tips, with very distinct lateral dermal fringes, second and fourth subequal. Toes bulbous at the tips but not dilated, free but with very wide lateral fringes proximally. Subarticular tubercles on hands very well developed, those on feet much less so; a small inner metatarsal tubercle, but no outer one. Tibio-tarsal articulation reaching the axilla. Skin smooth above and beneath; a fold from posterior corner of eye, widening greatly behind the arm and extending to the groin, curving in towards the back in its posterior part, widening until it suggests a heavy gland.

Dimensions.—Head and body 25.5 mm.; head length 6 mm., width 7 mm.; femur 8 mm.; tibia 9 mm.; foot 8 mm.; hand 6 mm.

Color in alcohol.—Dorsum nearly uniform drab, with a few slightly paler spots on the shoulders; arms and legs above drab, with paler mottlings; venter drab, with more or less regular round light spots on belly and throat. No vocal sac in this specimen.

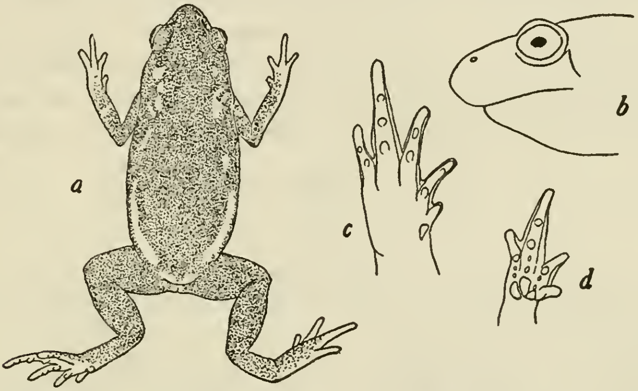


FIGURE 28.—*Chiasmocleis albopunctata,* IB 455: *a,* Dorsum × 1½; *b,* profile × 3; *c,* foot × 3; *d,* hand × 3.

Remarks.—This species is known from Paraguay and Mato Grosso as well as from Goiás. Intensive collecting will undoubtedly extend its known range still farther.

Chiasmocleis bicegoi Miranda-Ribeiro

1920. *Chiasmocleis bicegoi* MIRANDA-RIBEIRO, 1920c, p. 286, pl. [2], figs. 1–3 (type locality, Os Perús, São Paulo); 1926, pp. 187, 226.—PARKER, 1934a, p. 118.—DUNN, 1949, p. 6.

Description.—Since I have not seen an example of this very rare form, a translation of the original description is given:

> Eyes 1½ times into the snout; the canthus rostralis evident, forming a perfect acute angle; eyelids convex, projecting. A tympanic fold extending to the articulation of the upper arm. Hand as in *Atelopus*, the fingers slightly subglobose at the tip and in the following order of increasing length, 1, 2, 4, and 3; upper arm longer than forearm. When leg is stretched forward, tibiotarsal articulation does not reach the tympanum. The subarticular tubercles indistinct. Skin smooth; metatarsal tubercles indistinct; neck without transverse skinfold; color, dark like that of a dry leaf, cinereous on upper surface; iris black; sides and

lower parts vermiculated with yellowish-brown color. A white rostrodorsal line, continued on the sacrum with another transverse one which traverses the posterior side of femur.

Dimensions: Body, 16 mm.; leg, 20 mm.

Specimens, 1, No. 595 [MP] from Os Perús, São Paulo, collected by Bicego in 1895.

Genus *Elachistocleis* Parker

1927. *Elachistocleis* PARKER, 1927a, p. 4. (Genotype, *Rana ovalis* Schneider.)

Generic diagnosis.—Prevomer divided, the postchoanal portion lost; palatine absent. Clavicle and precoracoid present, much reduced, curved, resting on the mesial half of the coracoid; omosternum absent; sternum cartilaginous. Vertebral column diplasiocoelous. Terminal phalanges simple. Pupil round, tongue oval, entire and free behind. Two smooth or slightly crenulate dermal ridges in front of the pharynx, the anterior shorter and curved. Digits free, the tips not dilated.

Elachistocleis ovalis (Schneider)

PLATE 33, FIGURES C, D

1799. *Rana ovalis* SCHNEIDER, p. 131 (no type locality given).

To the long synonymy of this species given by Parker (1934a, p. 121), the following references may be added:

1867. *Engystoma ovale* HENSEL, p. 140.—COPE, 1885a, p. 185.—BOULENGER, 1898a, p. 131.—BUDGETT, 1899, pp. 305, 310.—PERACCA, 1914, p. 104.

1888. *Engystoma ovale bicolor* BOULENGER, 1888c, p. 416.—L. MÜLLER, 1922, p. 171.—MÜLLER and HELLMICH, 1936, p. 92, fig. 33.—CARVALHO, 1939a, p. 280.

1919. *Gastrophryne ovale* BEEBE, p. 124.

1926. *Engystoma ovale cesarii* MIRANDA-RIBEIRO, p. 184, footnote (type locality, São Paulo).

1926. *Engystoma cesarii-moitae* (nomen nudum) MIRANDA-RIBEIRO, p. 184, footnote.

1926. *Engystoma ovale concolor* MIRANDA-RIBEIRO, p. 185 (type locality, Ypiranga, São Paulo).

1930. *Elachistocleis ovalis* MERTENS, p. 163.—MYERS, 1942, p. 155.—DUNN, 1949, p. 13.

Description.—Adult male, USNM 121333, Butantan, São Paulo. Snout elongate, forming an acute angle rounded at the tip when viewed from above and in profile, nearly 1½ times the eye diameter; upper jaw projecting considerably beyond lower, which has the same truncate, trilobed anterior margin as in *Microhyla subnigra*; tongue large, nearly two-thirds the width of mouth opening, long and oval, without a notch in its very free posterior border; nostrils anterolateral, their distance from end of snout about two-fifths of their distance from eye, the interval between them three-fourths their distance from eye; no furrow below nostrils; canthus rostralis rounded, merging with the flat, slanting loreal region, which is scarcely set off from the bulging upper lip; eye very small, only slightly projecting, its diameter two-thirds its distance from tip of snout, equal to its distance from nostril; upper eyelid narrow, one-third the interorbital width. Body very stout, in postaxillary region about twice the width of head. Fingers short, free, with distinct lateral ridges, fourth much longer than second, reaching to base of penultimate phalanx of third; two or three moderate palmar calluses; metacarpal tubercles well developed. Toes with a slight trace of web and well-marked lateral ridges, third longer than fifth, reaching nearly to base of penultimate phalanx of fourth; a small inner but no outer metatarsal tubercle, the other tubercles on toes well developed; no tarsal ridges. When hind leg is extended forward, heel fails to reach axilla; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels touch. Skin above minutely pustular, with a few larger glands around anus and on posterior femur; venter also minutely pustular; indications of a skinfold across back of head; a pair of heavy lateral skinfolds from shoulder to groin; a skinfold across chest between axillae.

Dimensions.—Head and body 36 mm.; head length 8.5 mm., width, 9 mm.; femur 10.5 mm.; tibia 12.5 mm.; foot 14 mm.; hand 8 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	13	13	13	13	13	13
Mean	23. 5	25. 9	33. 5	36. 8	41. 9	22. 2
Standard deviation	1. 81	1. 55	2. 23	1. 86	1. 96	2. 35
Variation	7. 7	6. 0	6. 7	5. 0	4. 7	10. 6
Standard error	. 50	. 43	. 62	. 52	. 54	. 65
Range	20. 2– 26. 7	22. 8– 27. 9	29. 2– 37. 5	34. 7– 41. 7	32. 9– 45. 8	18. 0– 27. 1

Color in alcohol.—Dorsum wood brown, immaculate except for a light line along posterior femur; venter buff, immaculate.

Variations.—While the specimens at hand usually have larger or smaller white spots in the groin, or at least an extension of the light ventral coloration into that area, they vary considerably in the degree of white on the posterior and lower leg surfaces. The one from Tapera, Pernambuco, has a regular narrow white postfemoral stripe, but it does not continue past the knee, while the lower tibia is thickly covered with anastomosing brown lines like the entire ventral surface. The paratype of *Hypopachus pearsi*, USNM 51215, from Fundación, Colombia, has a wide white area on the posterior femur. Another frog from Colombia, USNM 14718, has a large, very irregular white patch on the posterior femur, leading into a white area, which covers the posterior and lower tibia almost completely. The Trinidad specimen, USNM 98779, has two round spots on the posterior femur. The ventral coloration does not seem to have zoogeographic significance, either, since examples with spotted as well as immaculate lower surfaces are found in widely separated areas.

Remarks.—The color pattern needs to be studied by rearing groups of frogs of known parentage in order to see whether the spotted ventral surface and the broad light femoral stripe are truly associated as a mutant of frogs having the immaculate venter and narrow femoral line. Dunn (1949) believes that two small species exist, one with immaculate white belly and a narrow stripe on the femur, the other with dark, light-dotted belly and a broad femoral stripe.

Specimens examined

BRAZIL:

Minas Gerais: Rio Pandeiro, IB 508. Sete Lagôas, CM 2644–5, Haseman, May 8, 1908.

Pernambuco: Caruaru, USNM 97106, Pickel. Tapera, USNM 97088, Pickel, Dec. 4, 1928.

Rio de Janeiro: CM 2511, Haseman.

Rio Grande do Sul: Near Pôrto Alegre, ZSBS (1), Gliesch, Aug. 25, 1926.

Santa Catarina: Lagôa, IB 554, 562–4, 568, USNM 121332. Ouro Verde, ZSBS (1), Löffler, Nov. 15, 1927. São Leopoldo, USNM 103617, Plaumann, November 1937.

São Paulo: Butantan, USNM 121333; IB 184, 186. Jundiaí, IB 576. Luzitania, IB 109.

COLOMBIA: USNM 14718, King. Fundación, USNM 51215 (paratype of *Hypopachus pearsi*), Ruthven, Aug. 15, 1913.

PARAGUAY: Puerto Bertoni, USNM 94101, Bertoni.

TRINIDAD: Nariva Swamp, USNM 98779, Weber, Dec. 4, 1934.

Genus *Hypopachus* Keferstein

1867. *Hypopachus* Keferstein, p. 351. (Genotype, *Hypopachus seebachii* Keferstein = *Engystoma variolosum* Cope).

Generic diagnosis.—Prevomer divided, the postchoanal portion absent; palatine absent. Clavicles and prevomer present, almost straight, reaching the midline of the girdle and the scapulae; omosternum absent, sternum cartilaginous. Vertebral column diplasiocoelous. Terminal phalanges simple. Pupil round or rhomboidal. Tongue large, oval, entire and half free behind. Two smooth dermal ridges across the palate in front of the pharynx, the anterior much shorter than the posterior. Digits not dilated. Tympanum hidden; first finger shorter than second, and third toe longer than fifth.

Hypopachus müllleri (Boettger)

Plates 33, Figures e–g

1885. *Engystoma mülleri* Boettger, p. 241 (type locality, Paraguay); 1892, p. 22.—Boulenger, 1894, p. 347.
1895. *Hypopachus mülleri* Peracca, p. 23; 1897, p. 16.—Andersson, 1906, p. 4.—Miranda-Ribeiro, 1926, pp. 189, 226, fig. 101; 1937a, p. 56.—Mello-Leitão, 1937, p. 315.—Carvalho, 1948, pp. 1–3, figs. 1,a, 2,a, 3,a, 4,a.—Schubart, 1939, p. 57.
1898. *Hypopachus muelleri* Boulenger, 1898b, p. 126.—Carvalho, 1939a, p. 280.
1904. *Dermatonotus mülleri* Méhely, p. 208, pl. 13, figs. 1–3.—Nieden, 1926, p. 72.
1910. *Gastrophryne muelleri* Stejneger, p. 166.
1934. *Hypopachus incrassatus* (not of Cope) Parker, 1934a, pp. 111–2.—Müller and Hellmich, 1936, p. 94, figs. 34, 35.—Dunn, 1949, p. 2.

Description.—Adult male, USNM 97990, Bello Horizonte, Minas Gerais. Head very short; tongue more than three-fourths the width of mouth-opening, attached behind but free on the sides; upper jaw projecting considerably beyond lower. Snout obtusely rounded; canthus rostralis blunt, merging with the slanting loreal region which ends in a slight concavity above the upper lip. Nostrils superolateral, very large, valvular but not projecting, their distance from end of snout about one-half their distance from eye, the interval between them about three-fourths the length of snout. Eye moderate in size but prominent, its diameter equal to snout length. Interorbital diameter twice that of upper eyelid, 1½ times the interval between nostrils. Fingers free, short, second slightly greater than fourth, reaching to base of penultimate phalanx of third; an oval tubercle at base of first finger, and two others similar to it on palm; metacarpal tubercles fairly well developed; very distinct dermal folds on sides of second and third fingers, less distinct on first and fourth. Toes very slightly webbed at base, short, third much longer than fifth, reaching half way on antepenultimate phalanx of fourth; a small pointed inner metatarsal tubercle but no outer one; subarticular tubercles prominent, pointed, single; distinct dermal ridges on sides of toes but none on tarsus. When hind legs are extended forward, heel barely reaches to axilla; when limbs are laid along the body, knee and elbow are widely separated; when hind legs are bent at right angles to body, heels are well separated. Skin very loose, smooth above, with minute pustules forming small flattened glands on sacrum and sides of body; a very prominent skinfold across the head just behind the eyes, bending backwards over the tympanic area and ending behind the mouth. Venter smooth, with loose longitudinal throat folds evidencing an external vocal sac in the male, as well as minute spinules on the throat.

Dimensions.—Head and body 62 mm.; head length 13 mm., width 17.5 mm.; femur 21 mm.; tibia 18.5 mm.; foot 21.5 mm.; hand 15.5 mm.

Mathematical analysis (in percentage of the total length):

	head length	head width	femur	tibia	foot	hand
Number	5	5	5	5	5	5
Mean	21. 6	27. 2	32. 9	29. 9	35. 0	24. 8
Standard deviation	1. 21	1. 51	1. 40	. 87	1. 07	. 39
Variation	5. 6	5. 6	4. 3	2. 9	3. 1	1. 6
Standard error	. 54	. 67	. 62	. 39	. 48	. 17
Range	20. 5– 23. 9	25. 7– 29. 6	30. 3– 34. 0	28. 5– 31. 0	33. 3– 36. 6	24. 3– 25. 4

Color in alcohol.—Dorsum chestnut brown; venter pale yellow, with a coarse, dark brown reticulation completely covering all surfaces of the body, this dark pattern thinning anteriorly to narrow disconnected blotches on head and shoulders, thickening to a large irregular black longitudinal spot on either side of sacrum and on upper part of femur; lower femur, anal region, and venter with round yellowish spots of fairly uniform size encircled by the brown network; palms and soles dull brown, the tubercles much lighter; throat black.

Color in life.—A rich olive green above, with yellow spots on sides and belly in a black ground. Throat nearly solid black.

Remarks.—The described specimen was collected in a dip net while catching minnows in a small duckweed-covered stream. A native fisherman who was passing by said that this species is used to bait fishhooks.

Specimens examined

BRAZIL: BM 1932.10.2.1, Steindachner.

AMAZONAS: Rio Livramento, AMNH 44787, Krukoff, February 1935. USNM 28928, Steere.

MINAS GERAIS: Januária, IB 418. Bello Horizonte, on road from Lagôa Santa, USNM 97990, Cochran, Lisboa, and Venancio, Mar. 14, 1935.

SÃO PAULO: Francisco Maximiano, IB 567. Luzitania, IB, 108. Orlândia, IB 255–6.

PARAGUAY: MHNP 90-141. Asunción, BM 1930.11.27.272–5, Schoute; ZSBS 119/29 (2), Second Chaco Expedition, December 1926. Nord-Chaco, ZSBS 134/32 (2), Third Chaco Expedition, July 5, 1931. Tacaaglí, ZSBS 120/29, Second Chaco Expedition, November 1925. Tumana, Chiquitos, ZSBS 118/29, Second Chaco Expedition, Oct. 23, 1926.

Genus *Microhyla* Tschudi

1838. *Microhyla* TSCHUDI, pp. 28, 71. (Genotype, *Hylaplesia achatina* Boie (nomen nudum) = *Microhyla achatina* Tschudi.)

Generic diagnosis.—Prevomer divided, the postchoanal portion lost; palatine present or absent. No clavicles, precoracoids or omosternum; sternum cartilaginous. Vertebral column diplasiocoelous. Terminal phalanges simple or T-shaped. Pupil circular. Tongue oval, entire and free behind; one or two smooth or crenulate dermal ridges across the palate in front of the pharynx. Digits with or without terminal dilatations. Tadpoles with toes more fully webbed before than after metamorphosis.

Microhyla subnigra (Miranda-Ribeiro)

PLATE 33, FIGURES H–L

1920. *Engystoma sub-nigrum* MIRANDA-RIBEIRO, 1920c, p. 285, pl. [1], pl. [2], fig. 7 (type locality, Serra de Macaé, Rio de Janeiro); 1926, pp. 183, 225.

1934. *Microhyla subnigra* PARKER, 1934a, p. 150.—DUNN, 1949, p. 17.

Description.—Young frog, USNM 97718, Guapi, Teresópolis, Rio de Janeiro. Snout very long, making an acute angle rounded at the tip when viewed from above and in profile; upper jaw projecting greatly beyond the lower; tongue large, over three-fourths the width of mouth-opening, round and free posteriorly; lower jaw curiously truncate in front, with three swollen areas, two lateral areas due to the bony extensions of the mandible and a third (inner) area, to the tongue attachment; nostrils lateral, their distance from end of snout one-half their distance from eye, the interval between them equal to their distance from eye; a deep furrow extends below the snout tip between the nostrils, nearly reaching the front of the upper lip, and causing the tip of the snout to have a bulbous appearance; eye very small, about one-third the snout length; canthus rostralis rounded, merging with the nearly vertical loreal region, which is set off from the upper lip by a distinct channel; upper eyelid narrow, about one-fourth of the interorbital diameter. Body stout, in postaxillary region almost twice the head width; fingers short, free, with small but distinct lateral dermal fringes, fourth much longer than second, extending to base of penultimate phalanx of third; two large palmar callosities; metacarpal tubercles not well developed. Toes free, with dermal ridges, third longer than fifth, extending halfway on antepenultimate phalanx of fourth; a small inner but apparently no outer metatarsal tubercle; no apparent tarsal ridge; the enlarged pads on lower sides of toes poorly developed. When hind leg is extended forwards, heel reaches to shoulder; when limbs are laid along the sides, knee and elbow are widely separated; when hind legs are bent at right angles to the body, heels just touch. Skin smooth above and below.

Dimensions.—Head and body 19 mm.; head length 5.5 mm., width 5.5 mm.; femur 7 mm.; tibia 7.5 mm.; foot 8.5 mm.; hand 4 mm.

Color.—Dorsum pale wood brown, immaculate except for faint traces of wide darker bars across the tibia; venter pale drab, with indications of a lighter marbling on the belly and underside of legs.

Eyelids appear dark because of their translucence which permits the dark eyeball to show through them.

Remarks.—As yet, only this one species of *Microhyla* has been found in the three states under consideration.

Microhyla subnigra agrees with its relative *M. schirchi* from Rio Mutum, Espírito Santo, in having the toes not dilated; the latter, however, has a rudiment of a web and the skin of the head adherent to the skull, while the former has the toes free and the head skin smooth and not adhering to the skull.

M. microps from the Guianas and Brazil has the toes, except the inner one, dilated into small but distinct disks, with a groove separating their upper and lower surfaces.

Specimens examined

BRAZIL:

Rio de Janeiro: Guapi, Teresópolis, USNM 97718, Sandig, April 1935. Teresópolis, Lutz Coll.—(1), Venancio, April 1945. Serra de Macaé, MP (type of *Engystoma sub-nigrum*).

São Paulo: Ribeirão Pires, ZSBS 5, Bresslau, November 1913.

Genus *Stereocyclops* Cope

1870. *Stereocyclops* Cope, p. 165.—Carvalho, 1948, p. 4. (Genotype, *Stereocyclops incrassatus* Cope.)

Generic diagnosis.—The diagnosis of Carvalho is translated as follows:

> Cranium toothless, depressed and wide, much wider than long, with a parabolic outline. Ethmoid divided. Prevomer divided, median anterior portion forming the median internal border of the choanae; postchoanal portion present, long and narrow, within the proximity of the median anteroposterior line of the cranium, in width more or less uniform, superposed on the palatine, going up to the half of the latter, where it is united. Ossicles of ear developed.
>
> Clavicle and precoracoid present and well developed, extending from the scapula to the median anteroposterior line of the sternum.
>
> The clavicle is much recurved, forming almost a right angle in its proximal extremity with the scapula. Omosternum absent. Sternum large, cartilaginous. Vertical column diplasiocoele, the transverse apophyses of the eight presacral vertebrae long, so that those of the third vertebra exceed those of the sacrum. Urostyle longer than the rest of the column. Sacral vertebrae with long apophyses becoming flat and widening progressively, in proportion as they go away from the body of the vertebra. Terminal phalanges simple. Pupil oval, horizontal, somewhat rounded. Tongue entire, oval, having the posterior half concave and free. Two transverse folds on the roof of the mouth; the first smaller, smooth, between the apertures of the Eustachian tubes and the second larger, in the beginning of the aesophagus, with its posterior border free and fringed. Tympanum indistinct. Fingers of the hand in the following order of increase 1–2–4–3, having nevertheless 1, 2, and 4 almost equal, those of the foot 1–2–5–3–4.

Stereocyclops incrassatus Cope

Plate 34, Figure a

1870. *Stereocyclops incrassatus* Cope, p. 165 (type locality, São Matheus [in Espírito Santo, fide Carvalho]); 1889, p. 387.—Boulenger, 1882a, p. 159.—Gadow, 1901, p. 231.—Baumann, 1912, p. 161.—Nieden, 1926, p. 73.—Miranda-Ribeiro, 1926, pp. 192, 226, figs. 103, 104.—Carvalho, 1948, p. 5, figs. 1–6.

1920. *Emydops hypomelas* Miranda-Ribeiro, 1920c, p. 286, pl. [2], figs. 4–6 (type locality, Porto Cachoeira, Espírito Santo); 1926, pp. 188, 226.—Parker, 1927a, p. 2, fig. 2.

1934. *Hypopachus parkeri* Wettstein, p. 270, figs. 1, 2 (type locality, Colonia Santa Cruz, Rio de Janeiro).—Myers, 1946, pp. 15, 33.—Dunn, 1949, p. 4.

1934. *Hypopachus incrassatus* (part) Parker, 1934a, p. 111.—Müller and Hellmich, 1936, p. 94, figs. 34, 35.—Schubart, 1939, p. 57.—Travassos and Freitas, 1942, p. 283.

1949. *Ribeirina hypomelas* Dunn, p. 5.

Description.—An adult male, USNM 132736, Caxias, Rio de Janeiro. Snout short, rounded when viewed from above, more acute in profile; upper jaw projecting considerably beyond lower; tongue large, one-half width of mouth-opening, ovate in shape, with the smaller lobe at the free posterior end, not incised; anterior edge of lower jaw straight, without conspicuously swollen areas; nostrils on upper surface of snout, their distance from tip of snout one-half their distance from eye, the interval between them equal to their distance from eye; no furrow on front of snout; tympanum indistinct; eye small, one-half the snout length; canthus rostralis rounded; loreal region slightly concave, merging with the flaring upper lip border; upper eyelid narrow, one-third the interorbital diameter. Body very stout, in postaxillary region 1⅓ times the greatest head width. Fingers fairly long, free, without lateral ridges, second and fourth subequal, extending to base of penultimate phalanx of third; a large oval pad at base of first finger and two larger but less distinct ones on palm of hand; metacarpal tubercles well developed. Toes long, webbed at the base, the webs continuing as ridges part way towards the tip of each toe, third much longer than fifth, reaching halfway on antepenultimate phalanx of fourth; a large inner metatarsal tubercle, and a long, heavy ridge on outer side of foot representing an outer tubercle; side of tarsus between heel and inner tubercle swollen but not distinctly ridged; tubercles beneath toes large. When hind leg is extended, heel reaches nearly to posterior corner of eye; when limbs are laid along the sides, knee and elbow touch; when hind legs are bent at right angles to body, heels barely touch. Skin smooth above and below, with a few small granules on the sides; a pair of heavy transverse skin folds above the anus; a heavy fold curving above and behind the tympanic area and ending in front of the shoulder; throat with many transverse folds; a distinct fold across the chest, and a deeper one below each axilla.

Dimensions.—Head and body 41 mm.; head length 12.5 mm., width 15.5 mm.; femur 18 mm.; tibia 17.5 mm.; foot 20 mm.; hand 10.5 mm.

Color in alcohol.—Dorsum drab, with indistinct, irregular brown chevron-shaped markings. Throat black; remainder of ventral surface slate color, this shade extending onto the lower surfaces of the limbs including palms of hands and soles of feet, a light buff lateral stripe outlining the edges of the slate color along sides of body and on anterior and posterior surfaces of limbs; lower edge of snout from nostrils to lip border slate-gray; sides of head below canthal region olive, becoming darker posteriorly as far as the tympanic fold.

Remarks.—In Cope's original description the length of the type is given as 57 mm.

Specimens studied

BRAZIL:

Rio de Janeiro, Caxias, Cidade das Meninas, USNM 132736, Carvalho.

Statistical analyses

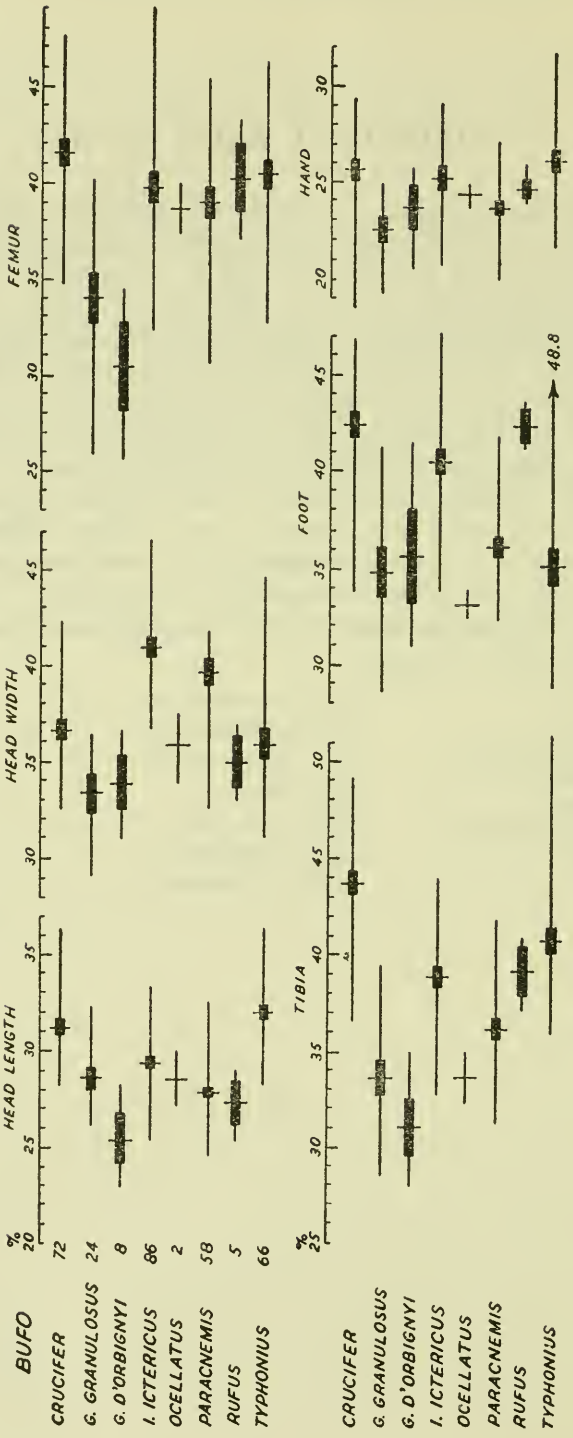
In the following graphs, six critical measurements expressed in percentages of the total length are compared. These graphs follow the plan suggested by Lee R. Dice and H. J. Laaras (Contr. Lab. Vert. Gen., Univ. Michigan, No. 3, 1936, pp. 1–3, 1 fig.).

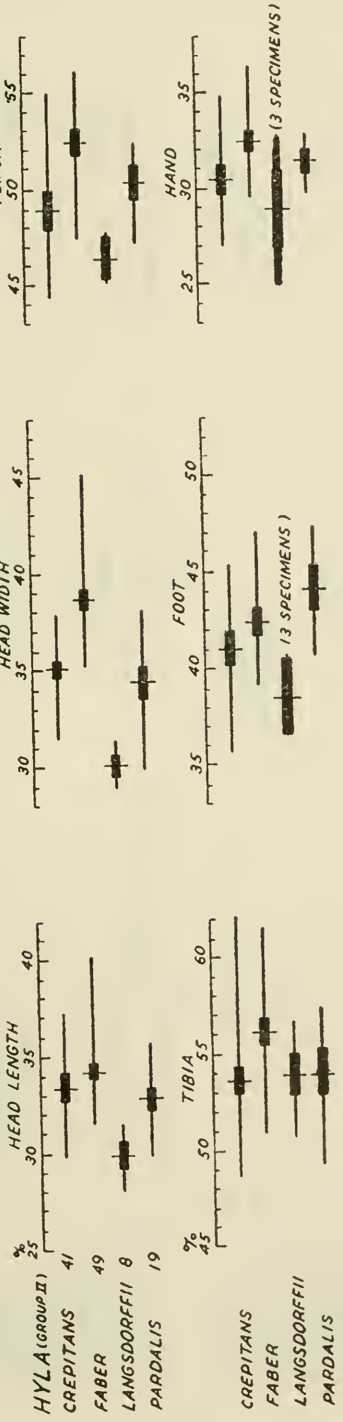
The horizontal lines represent ranges in each species and the vertical bars, the means. Solid blocks extend beyond the mean for a distance of twice the standard error of the mean. If the block for one species does not overlap the block for another species, there is a significant difference between these species in that particular character.

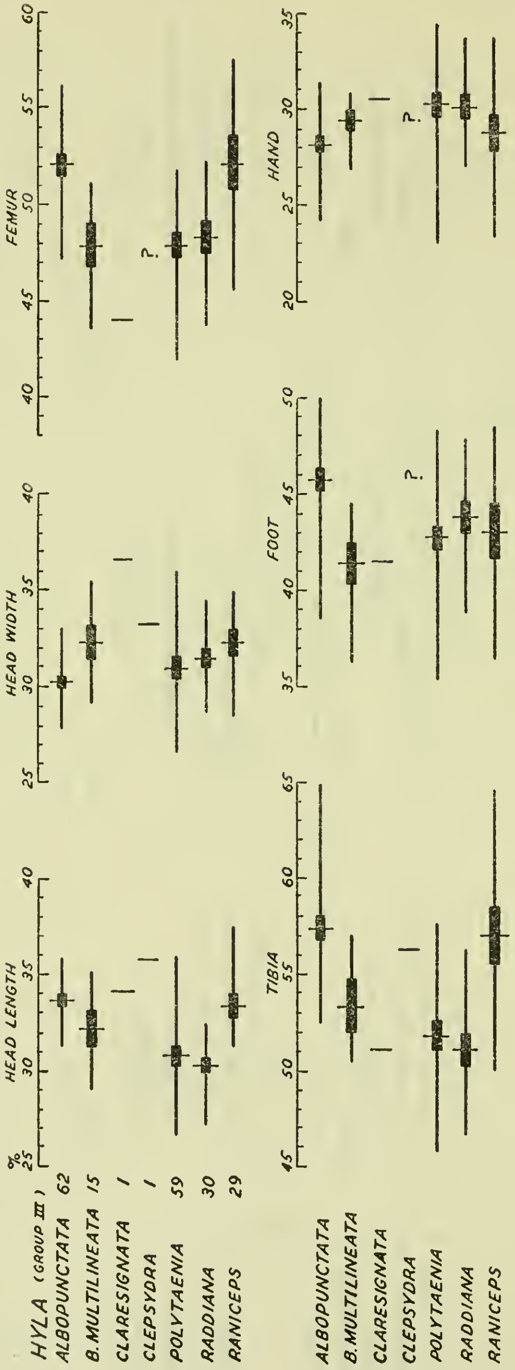
The number following the species name on each graph is the number of individuals on which measurements were made. When only a single specimen of a species is known, the actual measurement in percentage of the total length is shown by the vertical bar.

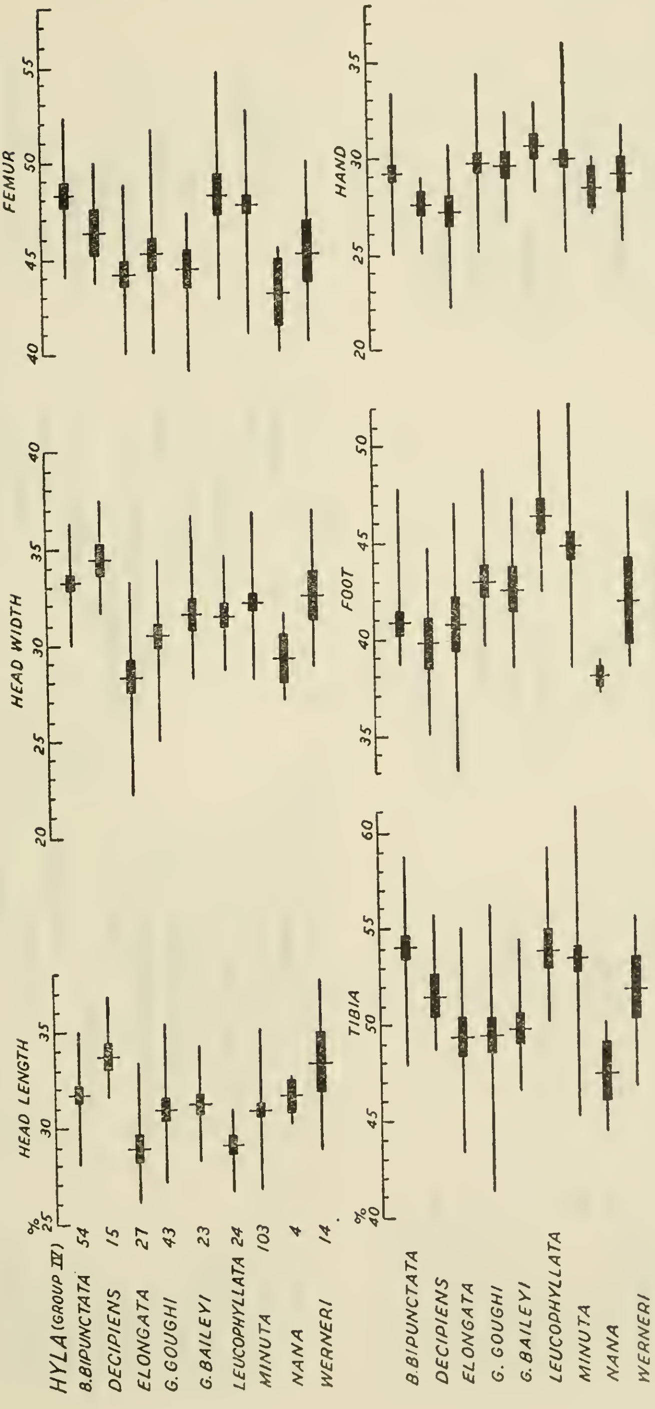
Statistical analyses are given for the following genera and generic groups on the pages indicated:

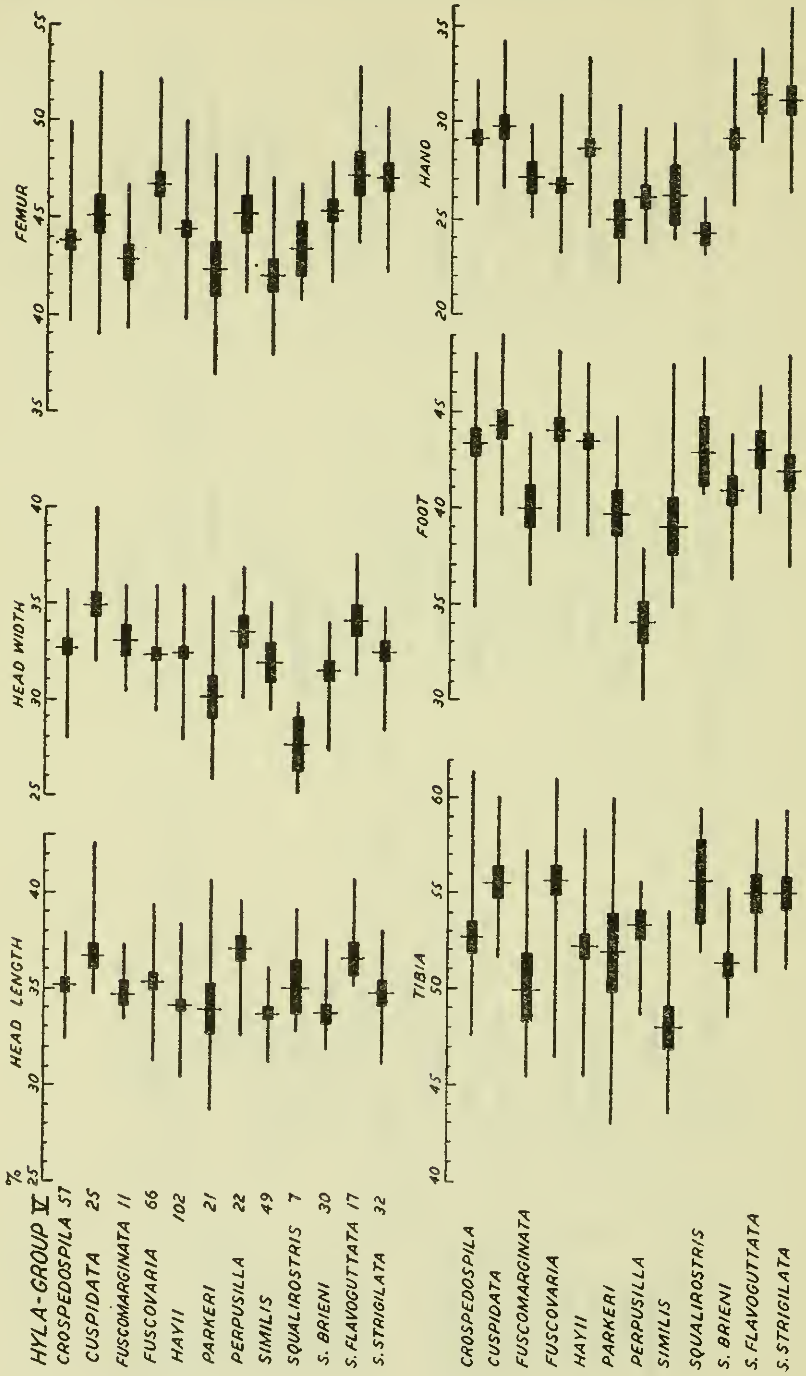
Bufo ---------- 374
Hyla faber group ---------- 375
Hyla albopunctata group ---------- 376
Hyla minuta group ---------- 377
Hyla rubra group ---------- 378
Hyla albomarginata group ---------- 379
Phyllomedusa ---------- 379
Ceratophrys ---------- 380
Crossodactylus ---------- 380
Cycloramphus ---------- 381
Eleutherodactylus ---------- 382
Elosia ---------- 383
Eupsophus ---------- 383
Leptodactylus ---------- 384
Physalaemus ---------- 385

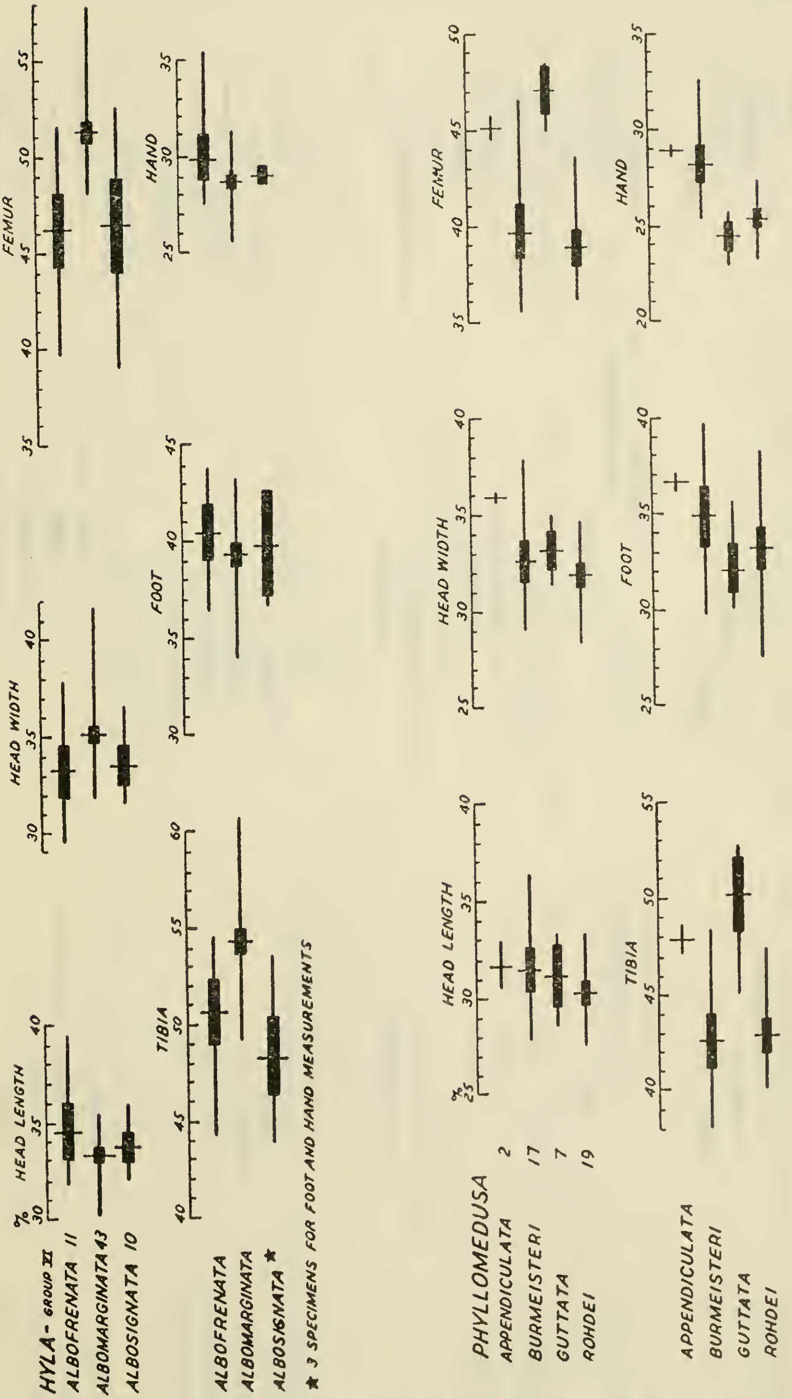

BUFO
CRUCIFER 72
G. GRANULOSUS 24
G. D'ORBIGNYI 8
I. ICTERICUS 86
OCELLATUS 2
PARACNEMIS 58
RUFUS 5
TYPHONIUS 66
%
20
25
30
35
HEAD LENGTH
30
35
40
45
HEAD WIDTH
25
30
35
40
45
FEMUR
CRUCIFER
G. GRANULOSUS
G. D'ORBIGNYI
I. ICTERICUS
OCELLATUS
PARACNEMIS
RUFUS
TYPHONIUS
%
25
30
35
40
45
50
TIBIA
30
35
40
45
FOOT
48.8
20
25
30
HAND

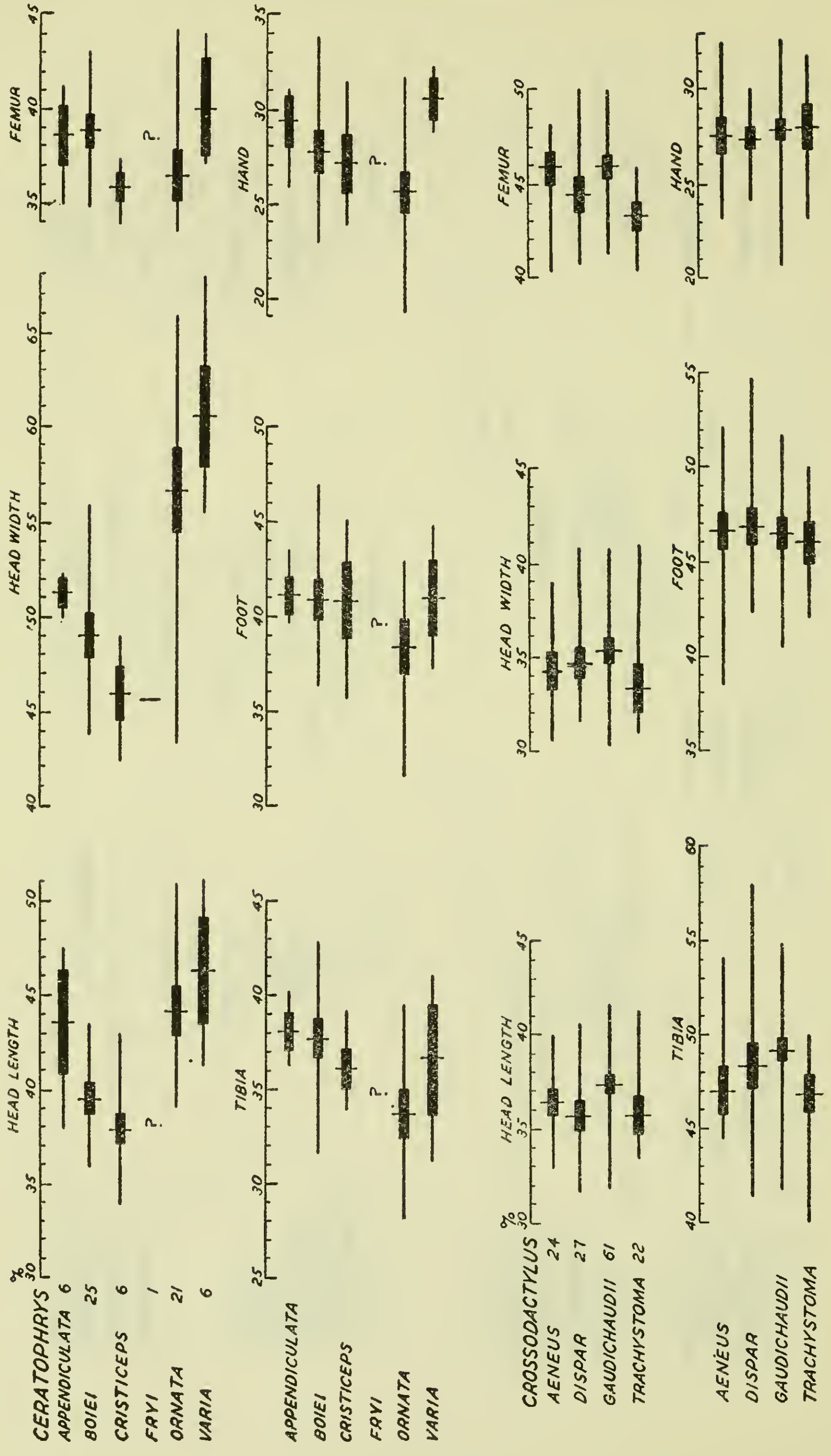

HYLA (GROUP II)
CREPITANS 41
FABER 49
LANGSDORFFII 8
PARDALIS 19
HEAD LENGTH
% 25
30
35
40
HEAD WIDTH
30
35
40
45
FEMUR
45
50
55
CREPITANS
FABER
LANGSDORFFII
PARDALIS
TIBIA
% 45
50
55
60
FOOT
35
40
45
50
(13 SPECIMENS)
HAND
25
30
35
(13 SPECIMENS)


HYLA (GROUP III)
ALBOPUNCTATA 62
B. MULTILINEATA 15
CLARESIGNATA 1
CLEPSYDRA 1
POLYTAENIA 59
RADDIANA 30
RANICEPS 29
%
HEAD LENGTH
25
30
35
40
HEAD WIDTH
25
30
35
40
FEMUR
40
45
50
55
60
?
ALBOPUNCTATA
B. MULTILINEATA
CLARESIGNATA
CLEPSYDRA
POLYTAENIA
RADDIANA
RANICEPS
TIBIA
45
50
55
60
65
FOOT
35
40
45
50
?
HAND
20
25
30
35
?


HYLA (GROUP IV)
B. BIPUNCTATA 54
DECIPIENS 15
ELONGATA 27
G. GOUGHI 43
G. BAILEYI 23
LEUCOPHYLLATA 24
MINUTA 103
NANA 4
WERNERI 14
HEAD LENGTH
%
25
30
35
HEAD WIDTH
20
25
30
35
40
FEMUR
40
45
50
55
TIBIA
%
40
45
50
55
60
FOOT
35
40
45
50
HAND
20
25
30
35
B. BIPUNCTATA
DECIPIENS
ELONGATA
G. GOUGHI
G. BAILEYI
LEUCOPHYLLATA
MINUTA
NANA
WERNERI


HYLA-GROUP V
CROSPEDOSPILA 57
CUSPIDATA 25
FUSCOMARGINATA 11
FUSCOVARIA 66
HAYII 102
PARKERI 21
PERPUSILLA 22
SIMILIS 49
SQUALIROSTRIS 7
S. BRIENI 30
S. FLAVOGUTTATA 17
S. STRIGILATA 32
%
HEAD LENGTH
25
30
35
40
HEAD WIDTH
25
30
35
40
FEMUR
35
40
45
50
55
CROSPEDOSPILA
CUSPIDATA
FUSCOMARGINATA
FUSCOVARIA
HAYII
PARKERI
PERPUSILLA
SIMILIS
SQUALIROSTRIS
S. BRIENI
S. FLAVOGUTTATA
S. STRIGILATA
TIBIA
40
45
50
55
60
FOOT
30
35
40
45
HAND
20
25
30
35


HYLA - GROUP II
ALBOFRENATA 11
ALBOMARGINATA 43
ALBOSIGNATA 10
%
HEAD LENGTH
30
35
40
HEAD WIDTH
30
35
40
FEMUR
35
40
45
50
55
ALBOFRENATA
ALBOMARGINATA
ALBOSIGNATA ★
TIBIA
40
45
50
55
60
FOOT
30
35
40
45
HAND
25
30
35
★ 3 SPECIMENS FOR FOOT AND HAND MEASUREMENTS
PHYLLOMEDUSA
APPENDICULATA 2
BURMEISTERI 17
GUTTATA 7
ROHDEI 19
%
HEAD LENGTH
25
30
35
40
HEAD WIDTH
25
30
35
40
FEMUR
35
40
45
50
APPENDICULATA
BURMEISTERI
GUTTATA
ROHDEI
TIBIA
40
45
50
55
FOOT
25
30
35
40
HAND
20
25
30
35


CERATOPHRYS
APPENDICULATA 6
BOIEI 25
CRISTICEPS 6
FRYI 1
ORNATA 21
VARIA 6
HEAD LENGTH
%
30
35
40
45
50
HEAD WIDTH
40
45
50
55
60
65
FEMUR
35
40
45
?
APPENDICULATA
BOIEI
CRISTICEPS
FRYI
ORNATA
VARIA
TIBIA
25
30
35
40
45
FOOT
30
35
40
45
50
HAND
20
25
30
35
CROSSODACTYLUS
AENEUS 24
DISPAR 27
GAUDICHAUDII 61
TRACHYSTOMA 22
HEAD LENGTH
%
30
35
40
45
HEAD WIDTH
30
35
40
45
FEMUR
40
45
50
AENEUS
DISPAR
GAUDICHAUDII
TRACHYSTOMA
TIBIA
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FOOT
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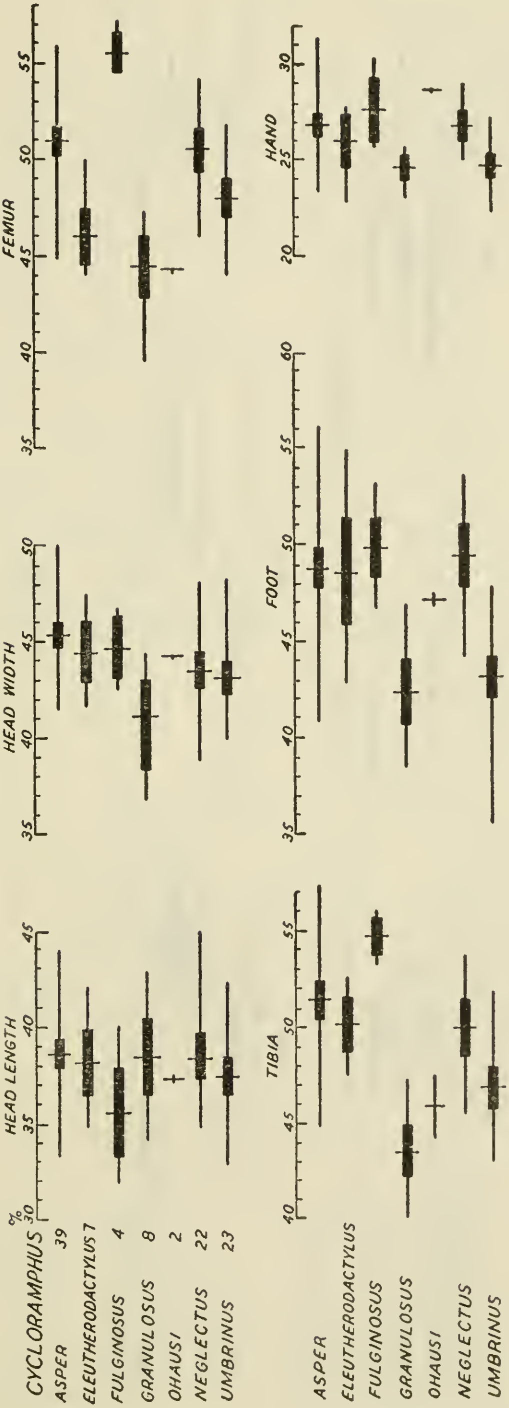
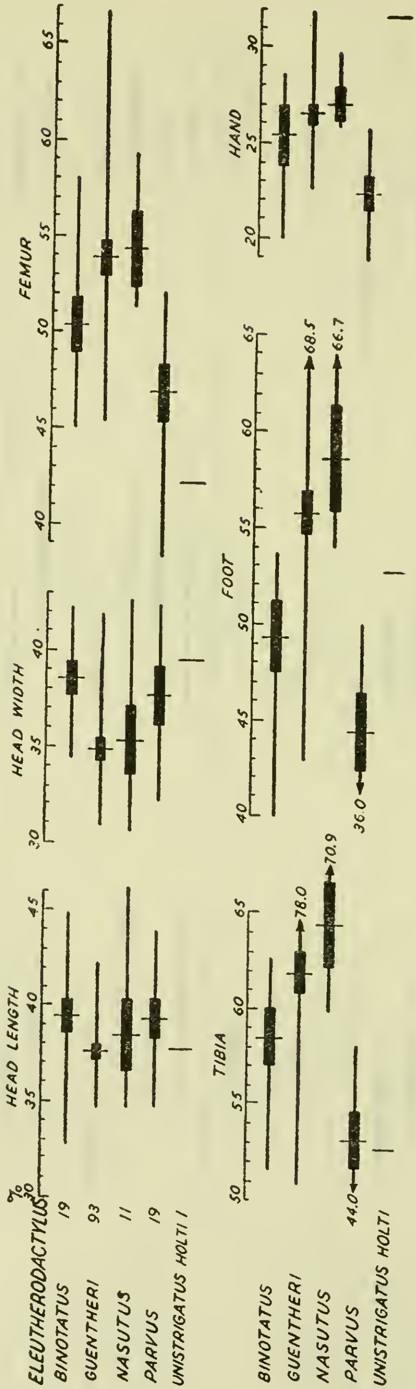
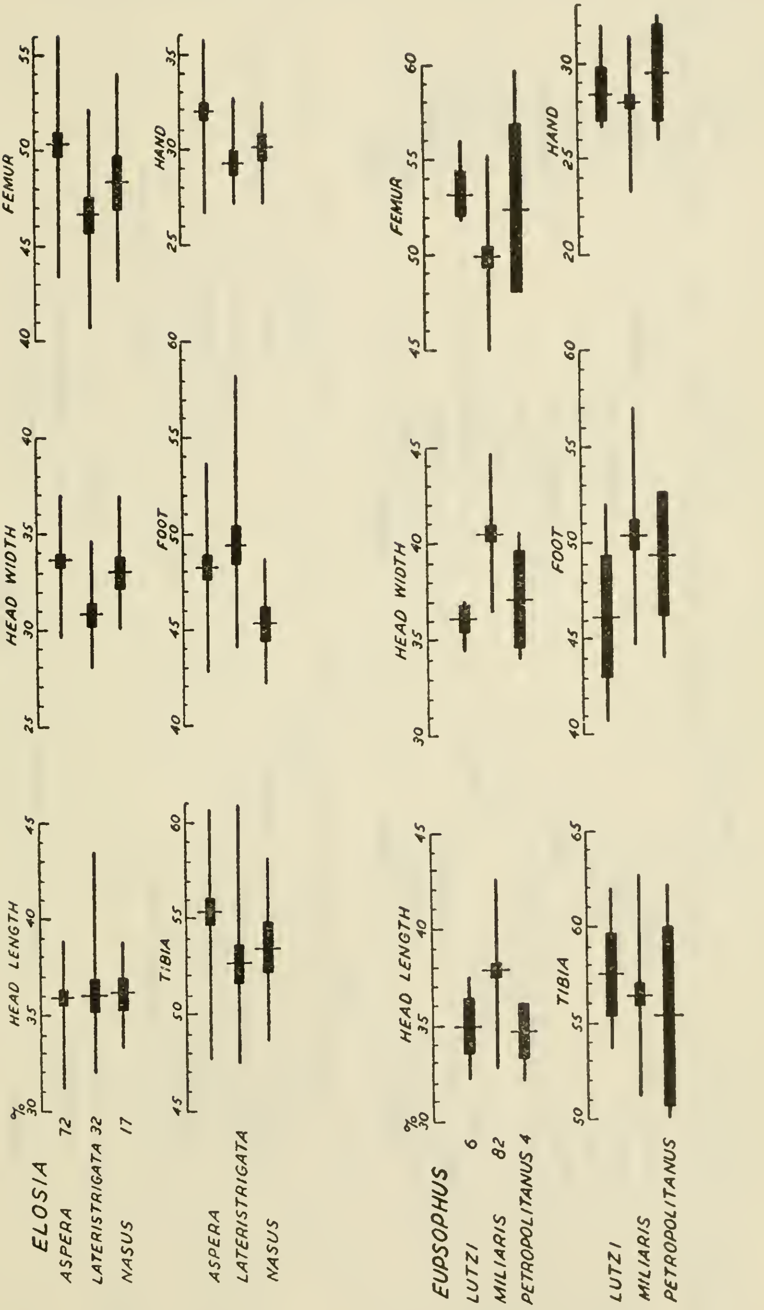
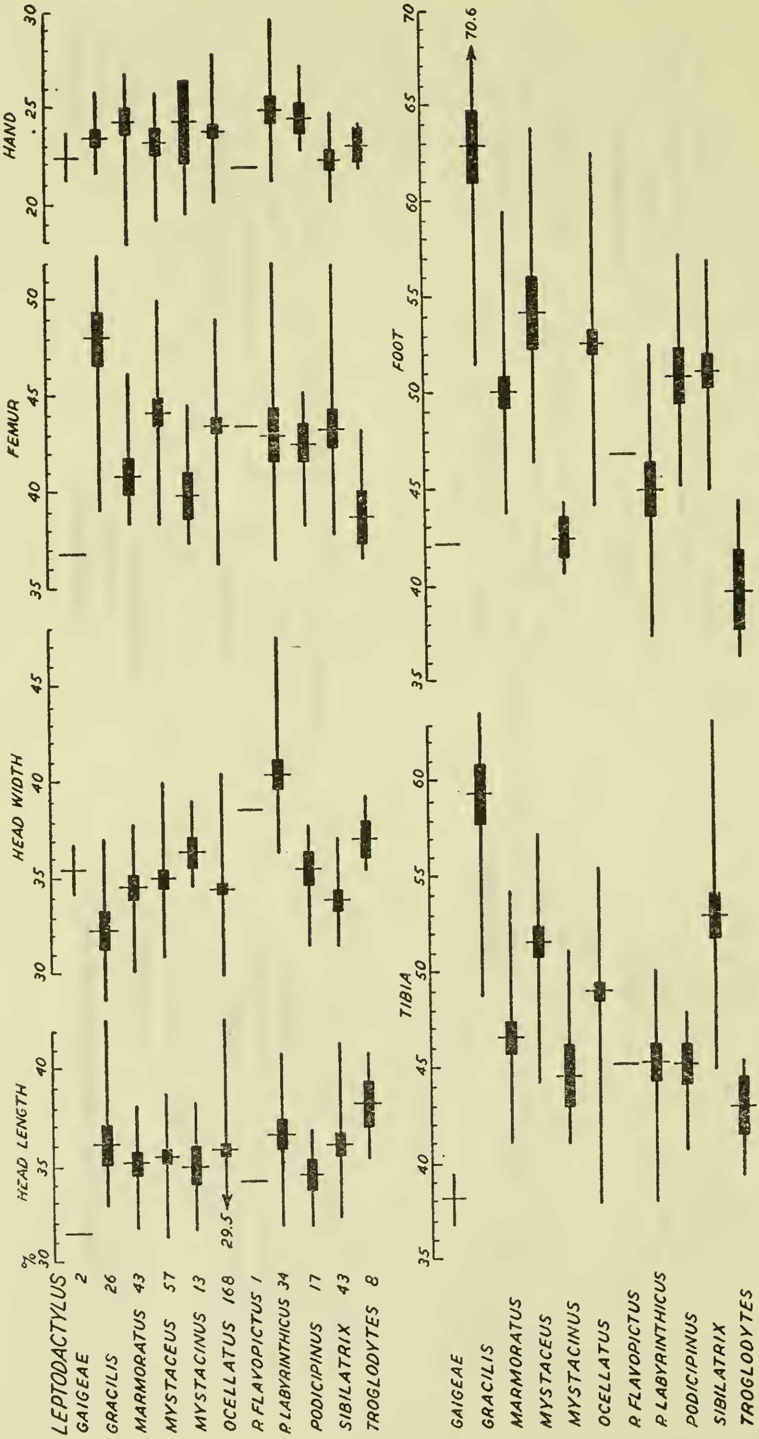
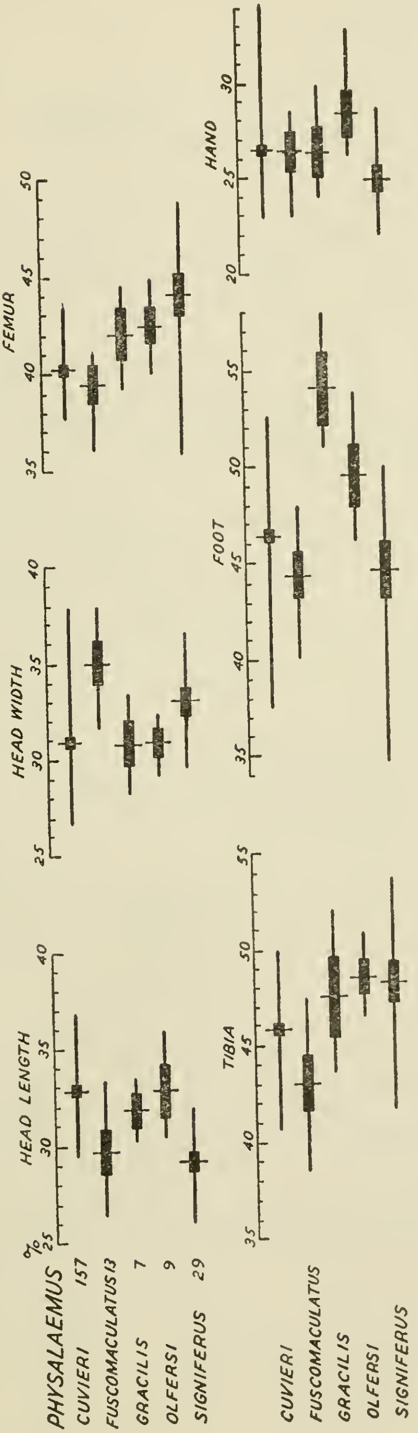
HAND
20
25
30


CYCLORAMPHUS
ASPER 39
ELEUTHERODACTYLUS 7
FULGINOSUS 4
GRANULOSUS 8
OHAUSI 2
NEGLECTUS 22
UMBRINUS 23
HEAD LENGTH
%
30
35
40
45
HEAD WIDTH
35
40
45
50
FEMUR
35
40
45
50
55
ASPER
ELEUTHERODACTYLUS
FULGINOSUS
GRANULOSUS
OHAUSI
NEGLECTUS
UMBRINUS
TIBIA
40
45
50
55
FOOT
35
40
45
50
55
60
HAND
20
25
30


%
ELEUTHERODACTYLUS
BINOTATUS 19
GUENTHERI 93
NASUTUS 11
PARVUS 19
UNISTRIGATUS HOLTI 1
HEAD LENGTH
30
35
40
45
HEAD WIDTH
30
35
40
FEMUR
40
45
50
55
60
65
BINOTATUS
GUENTHERI
NASUTUS
PARVUS
UNISTRIGATUS HOLTI
TIBIA
50
55
60
65
78.0
70.9
44.0
FOOT
40
45
50
55
60
65
68.5
66.7
36.0
HAND
20
25
30


ELOSIA
ASPERA 72
LATERISTRIGATA 32
NASUS 17
% 30
35
40
45
HEAD LENGTH
25
30
35
40
HEAD WIDTH
40
45
50
55
FEMUR
ASPERA
LATERISTRIGATA
NASUS
45
50
55
60
TIBIA
40
45
50
55
60
FOOT
25
30
35
HAND
EUPSOPHUS
LUTZI 6
MILIARIS 82
PETROPOLITANUS 4
% 30
35
40
45
HEAD LENGTH
30
35
40
45
HEAD WIDTH
45
50
55
60
FEMUR
LUTZI
MILIARIS
PETROPOLITANUS
50
55
60
65
TIBIA
40
45
50
55
60
FOOT
20
25
30
HAND


LEPTODACTYLUS
GAIGEAE 2
GRACILIS 26
MARMORATUS 43
MYSTACEUS 57
MYSTACINUS 13
OCELLATUS 168
P. FLAVOPICTUS 1
P. LABYRINTHICUS 34
PODICIPINUS 17
SIBILATRIX 43
TROGLODYTES 8
HEAD LENGTH
% 30
35
40
29.5
HEAD WIDTH
30
35
40
45
FEMUR
35
40
45
50
HAND
20
25
30
GAIGEAE
GRACILIS
MARMORATUS
MYSTACEUS
MYSTACINUS
OCELLATUS
P. FLAVOPICTUS
P. LABYRINTHICUS
PODICIPINUS
SIBILATRIX
TROGLODYTES
TIBIA
35
40
45
50
55
60
FOOT
35
40
45
50
55
60
65
70
70.6


PHYSALAEMUS
CUVIERI 157
FUSCOMACULATUS 13
GRACILIS 7
OLFERSI 9
SIGNIFERUS 29
%
HEAD LENGTH
25
30
35
40
HEAD WIDTH
25
30
35
40
FEMUR
35
40
45
50
CUVIERI
FUSCOMACULATUS
GRACILIS
OLFERSI
SIGNIFERUS
TIBIA
35
40
45
50
55
FOOT
35
40
45
50
55
HAND
20
25
30

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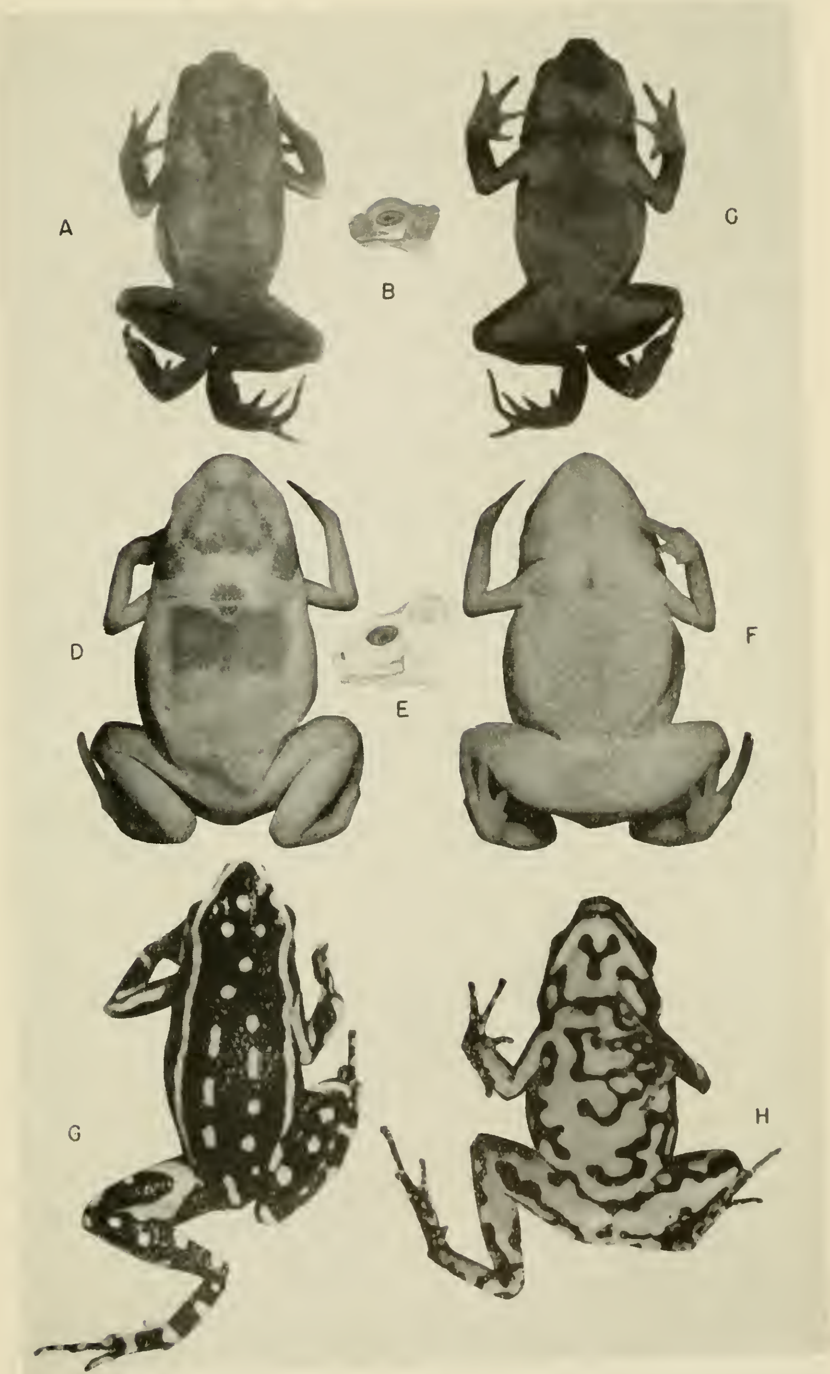
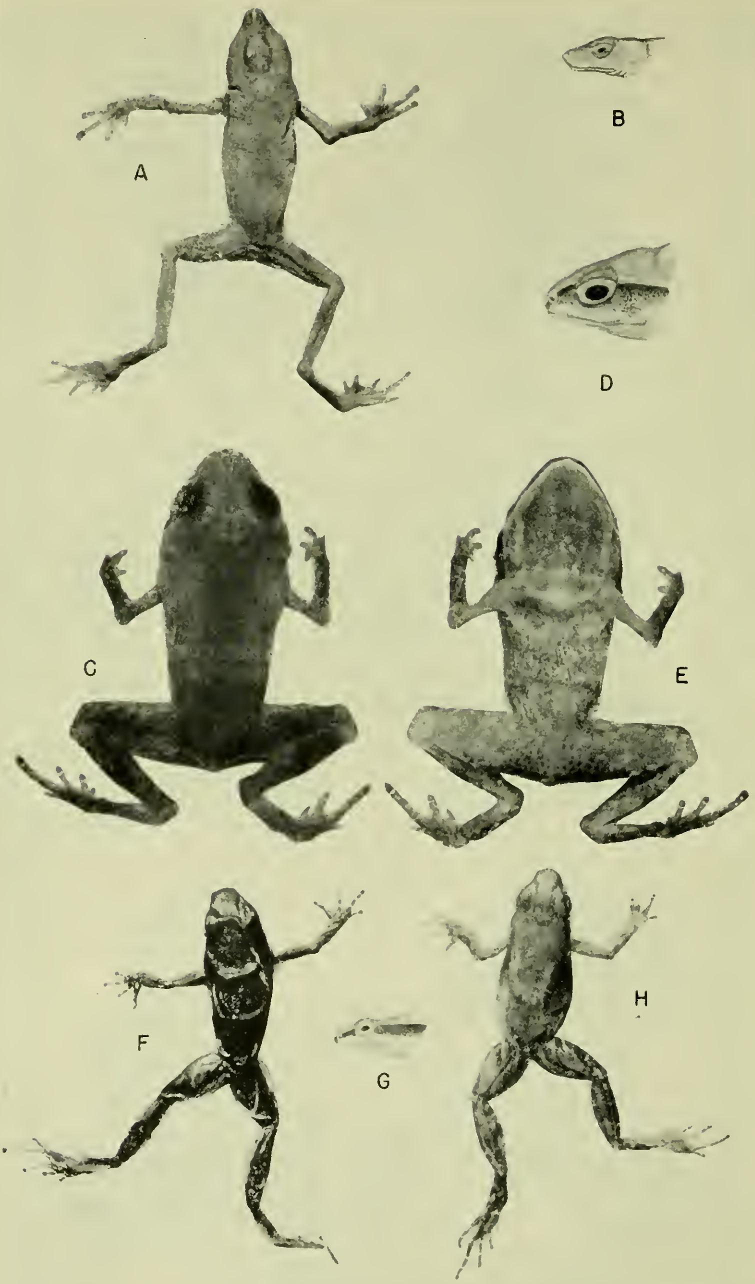
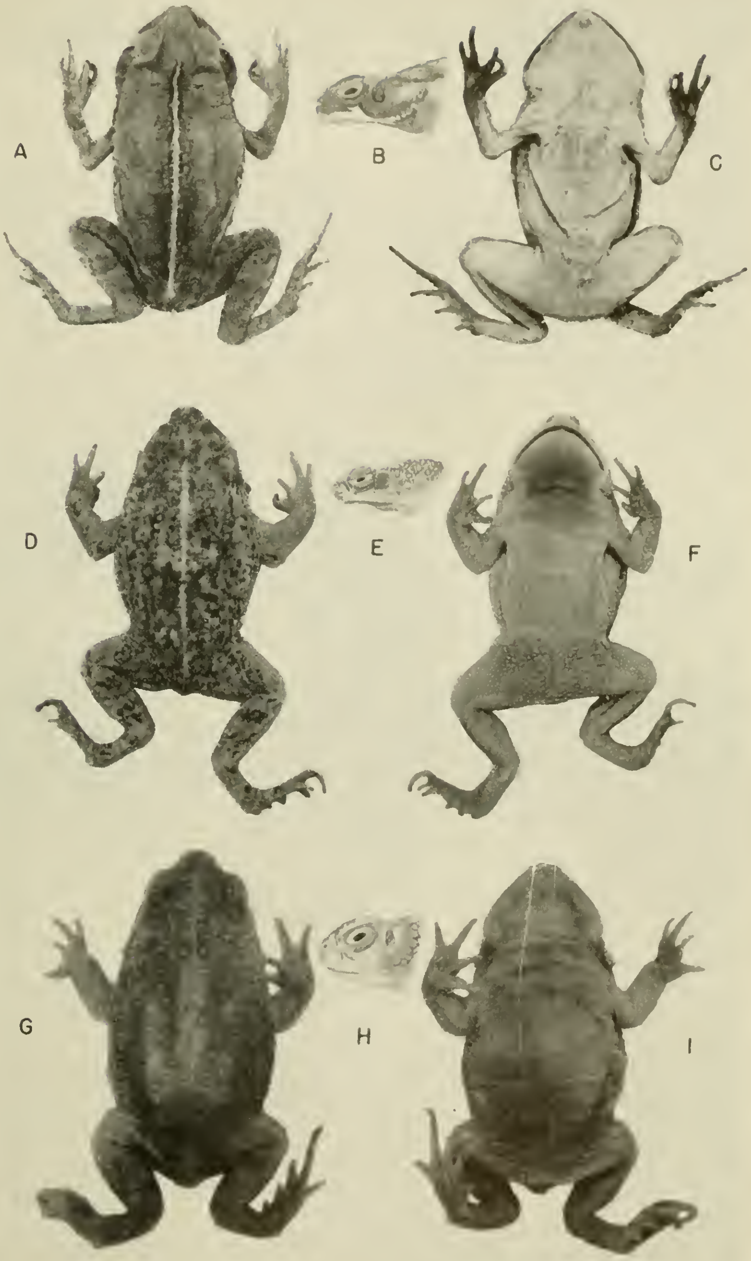


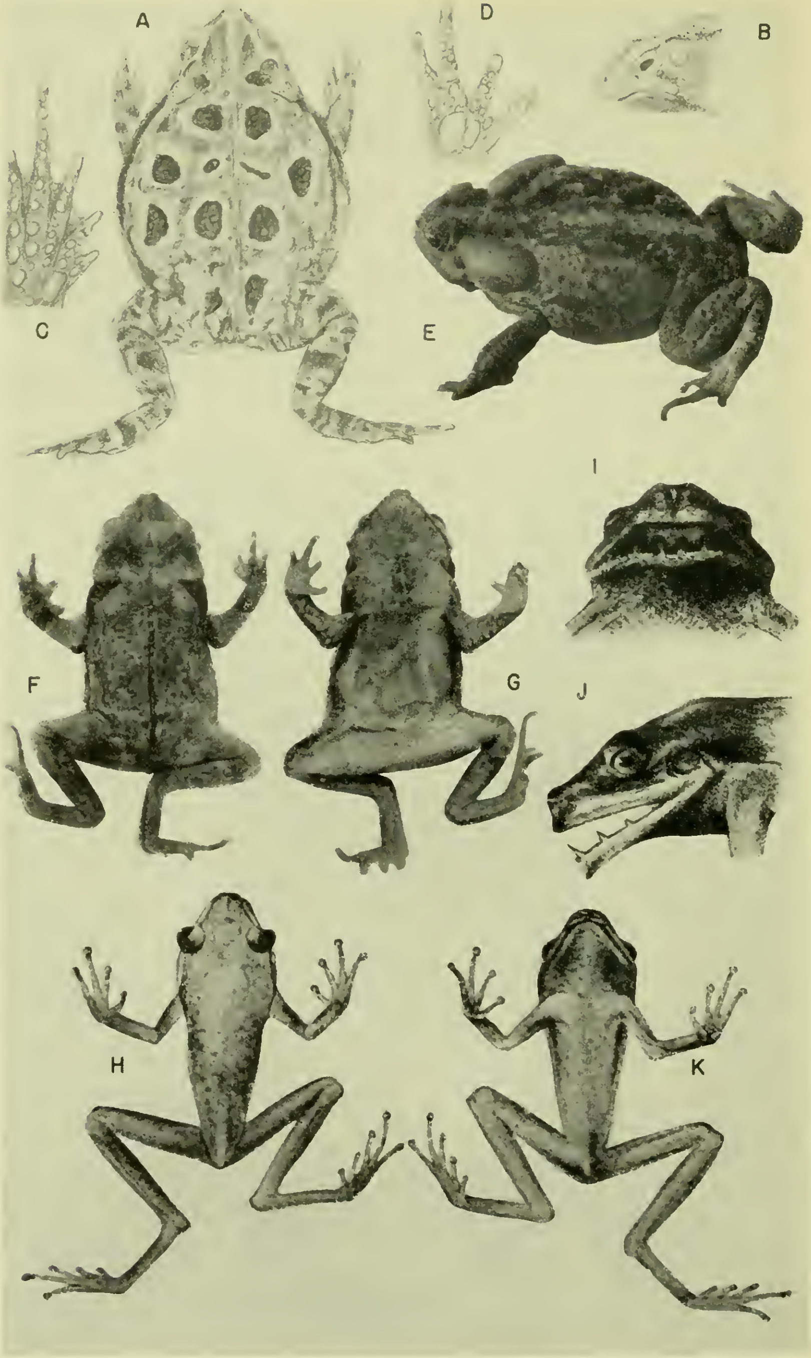
Atelopus moreirae moreirae (USNM 101725, × 1¾): A, dorsum; B, profile; C, venter. *Brachycephalus ephippium* (USNM 97425, × 2½): D, dorsum; E, profile; F, venter. *Dendrobates flavopictus* (Lutz Coll., photographed by Dr. Gualter Lutz; about natural size): G, dorsum; H, venter.



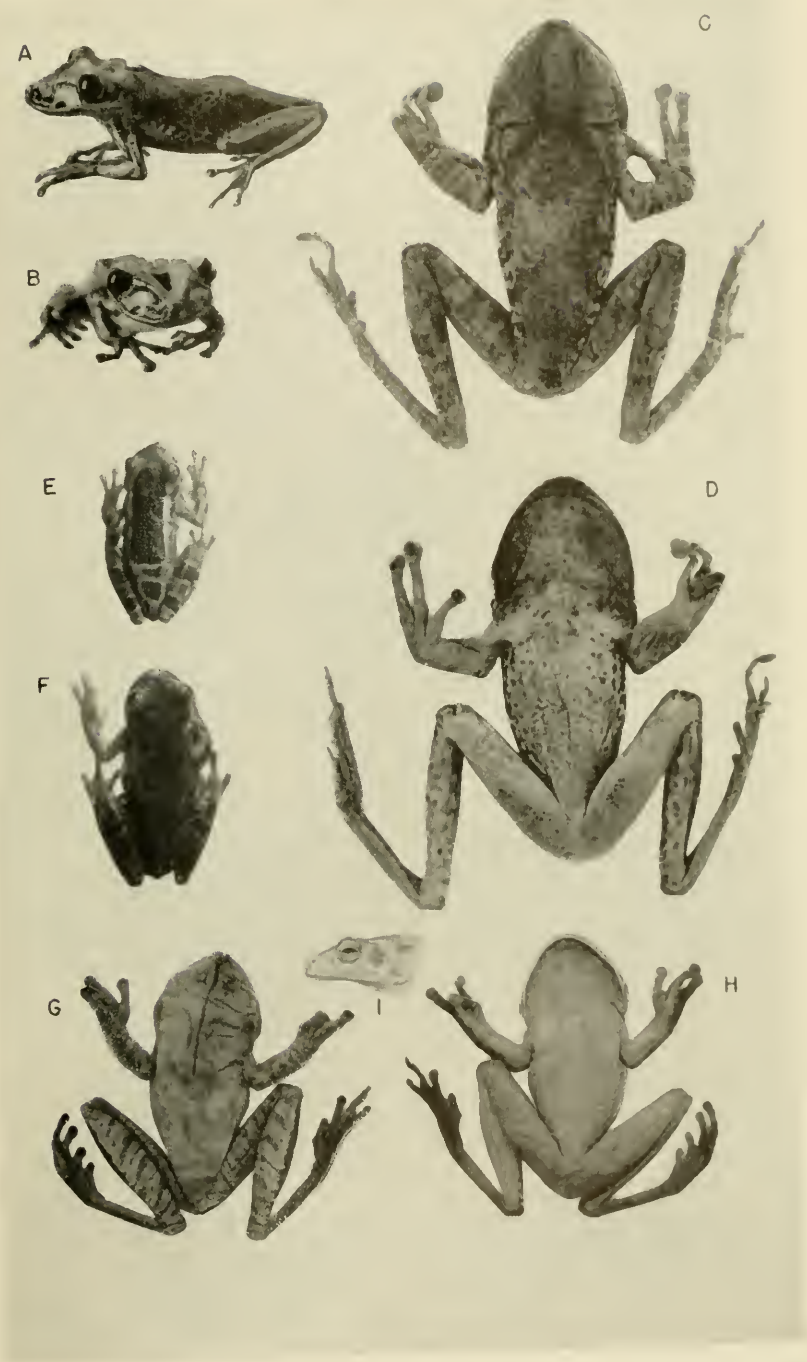
Dendrophryniscus brevipollicatus (USNM 96273, × 1½): A, dorsum; B, profile. *Noblella brasiliensis* (USNM 97717, × 3⅓): C, dorsum; D, profile; E, venter. *Phyllobates brunneus* (USNM 96540, cotype of *Eupemphix olfersioides* Lutz; × 1½): F, dorsum; G, profile. *P. brunneus* (USNM 97487, × 1½): H, dorsum.



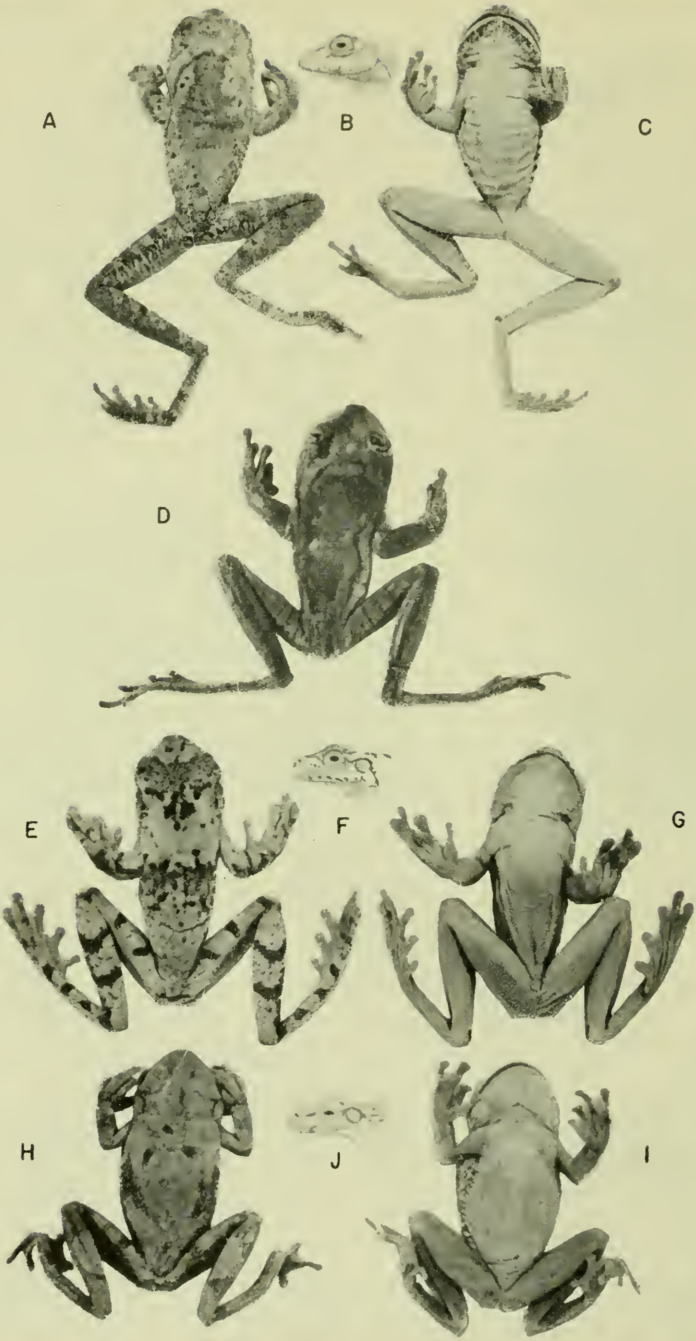
Bufo crucifer (USNM 97540, × 1/4): A, dorsum; B, profile; C, venter. *B. granulosus granulosus* (USNM 98245, × 3/8): D, dorsum; E, profile; F, venter. *B. g. d'orbignyi* (USNM 102314, × 3/4): G, dorsum; H, profile; I, venter.



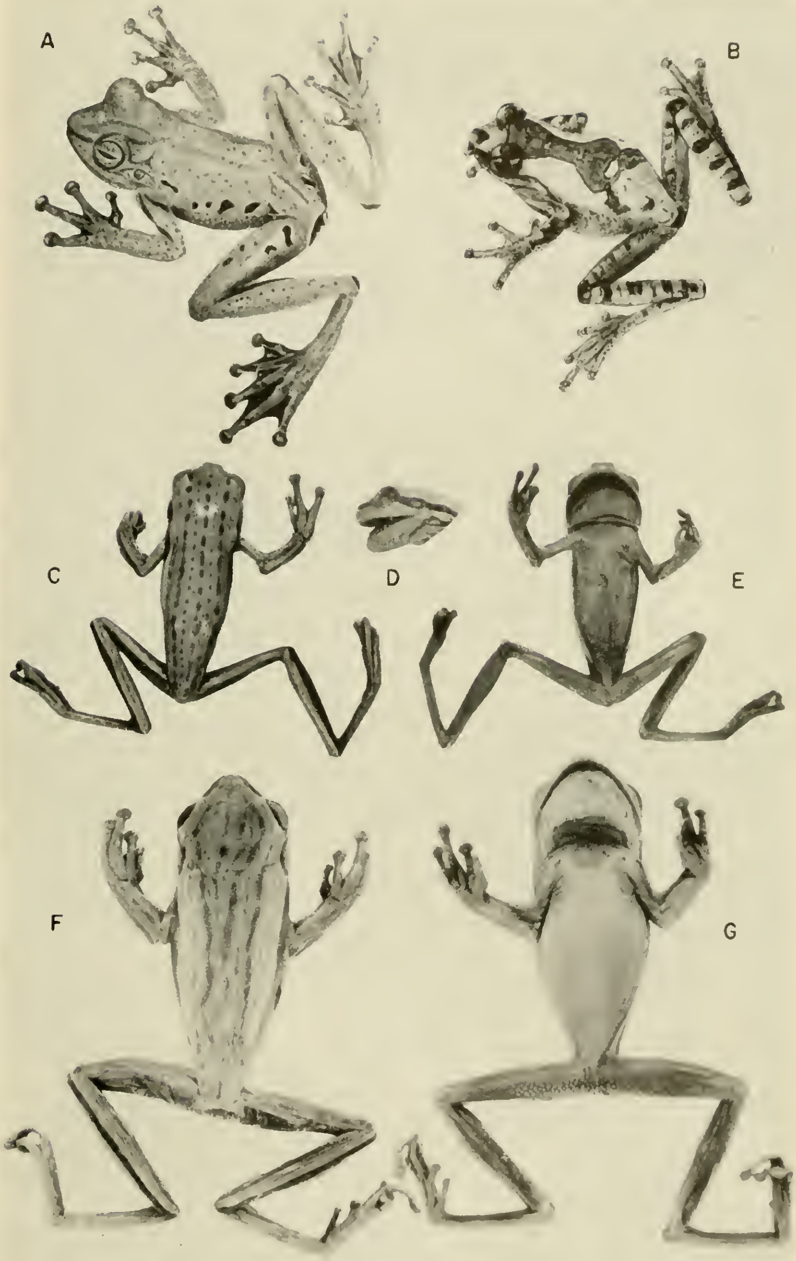
Bufo ocellatus (USNM 121333, × 3/8): A, dorsum; B, profile; C, foot; D, hand. *B ictericus ictericus* (photograph by Instituto Oswaldo Cruz): E, side view. *B. typhonius* (USNM 97711, × 3/8): F, dorsum: G, venter. *Amphodus piperatus* (copied from Miranda-Ribeiro, 1926): H, dorsum; I, profile; J, front of head; K, venter.



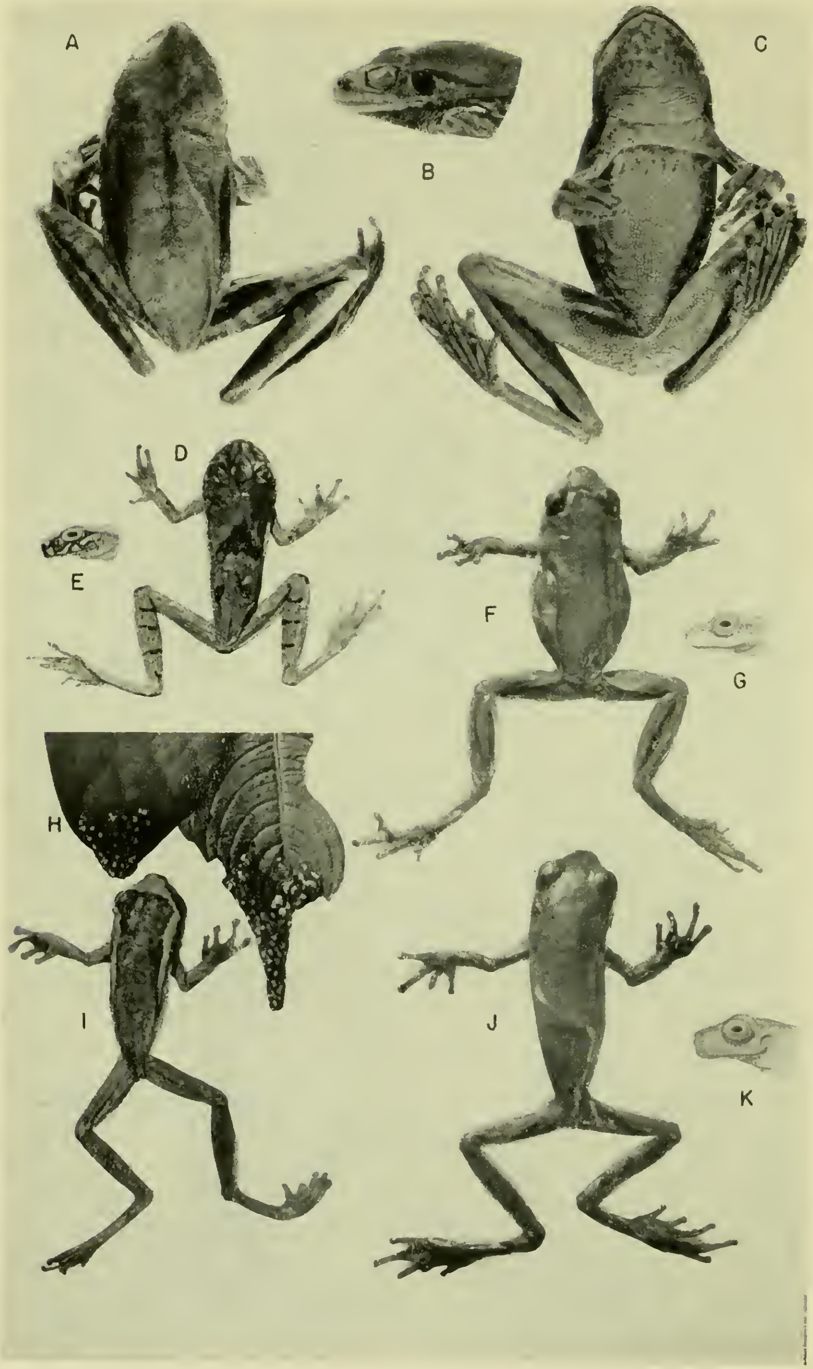
Aparasphenodon brunoi (photograph by Instituto Oswaldo Cruz, about $\frac{1}{4}$ natural size): A, side; B, front. *Gastrotheca microdisca* (MRHN IG 9404, Reg. 77, type of *Hyla parkeriana* de Witte; $\times \frac{3}{4}$): C, dorsum; D, venter. *Hyla imitatrix* (Lutz Coll., $\times \frac{1}{4}$): E and F, dorsal views of two living frogs. *H. faber* (USNM 97451, $\times \frac{2}{5}$): G, dorsum; H, venter; I, profile.



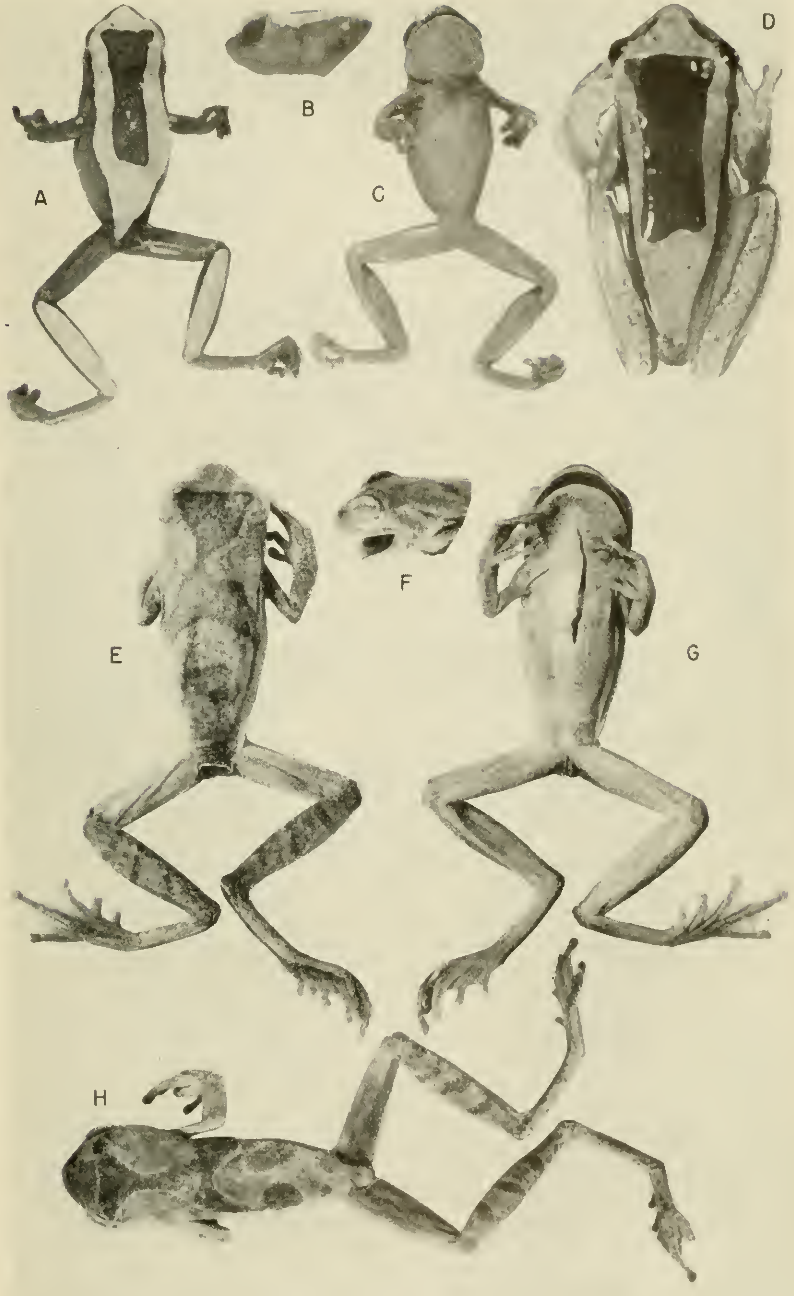
Hyla crepitans (USNM 52610, × ½): A, dorsum; B, profile; C, venter. *H. crepitans* (MCZ 1508, type of *H. circumdata* Cope; × ½): D, dorsum. *H. langsdorffii* (USNM 121337, × ⅖): E, dorsum; F, profile; G, venter. *H. pardalis* (USNM 81128), × ½: H, dorsum; I, venter; J, profile.



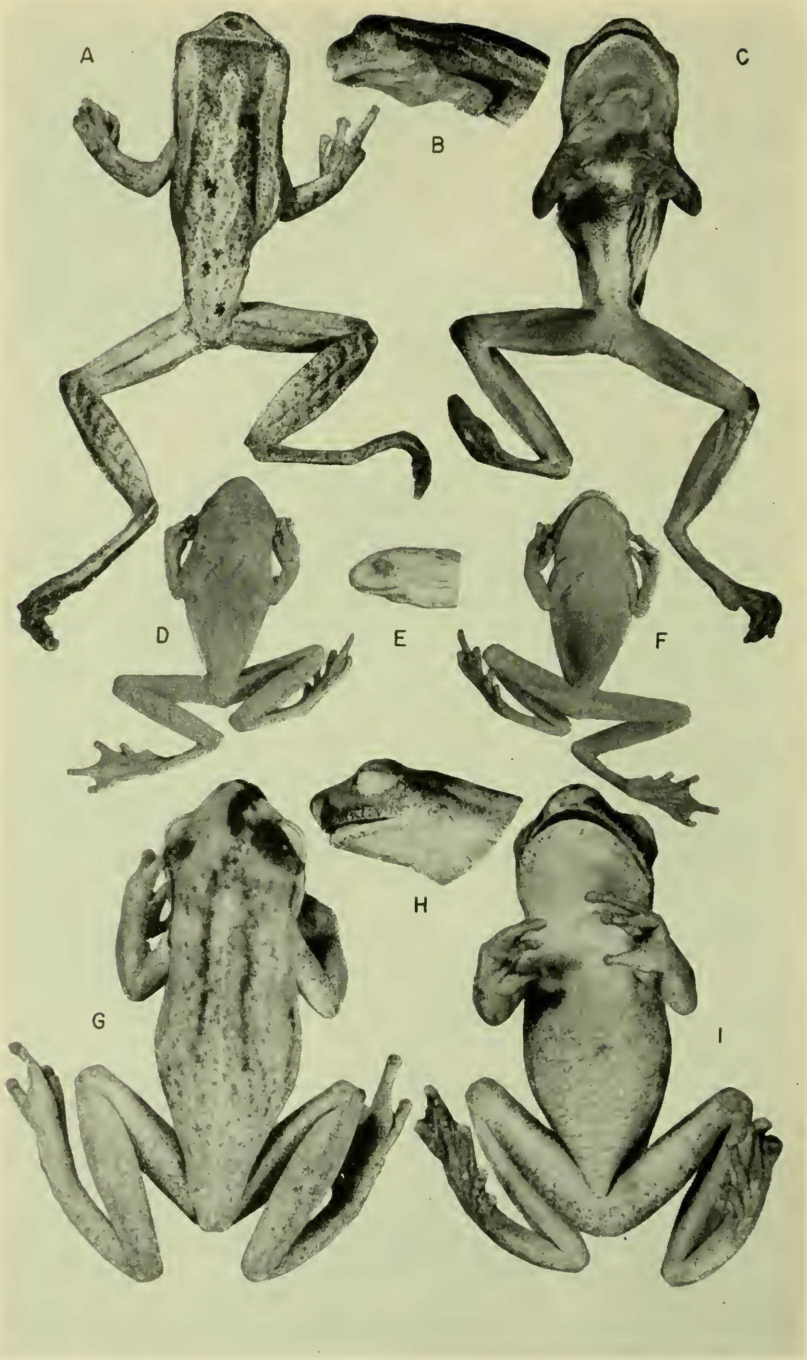
Hyla claresignata (drawing from Lutz Coll., about $^{1}/_{2}$ natural size): A, side view. *H. clepsydra* (drawing from Lutz Coll., about $^{3}/_{8}$ natural size): B, side view. *H. polytaenia* (USNM 98024, × $^{4}/_{5}$): C, dorsum; D, profile; E, venter. *H. polytaenia* (ZMB 7465, type of *H. striata* Peters); F, dorsum; G, venter.



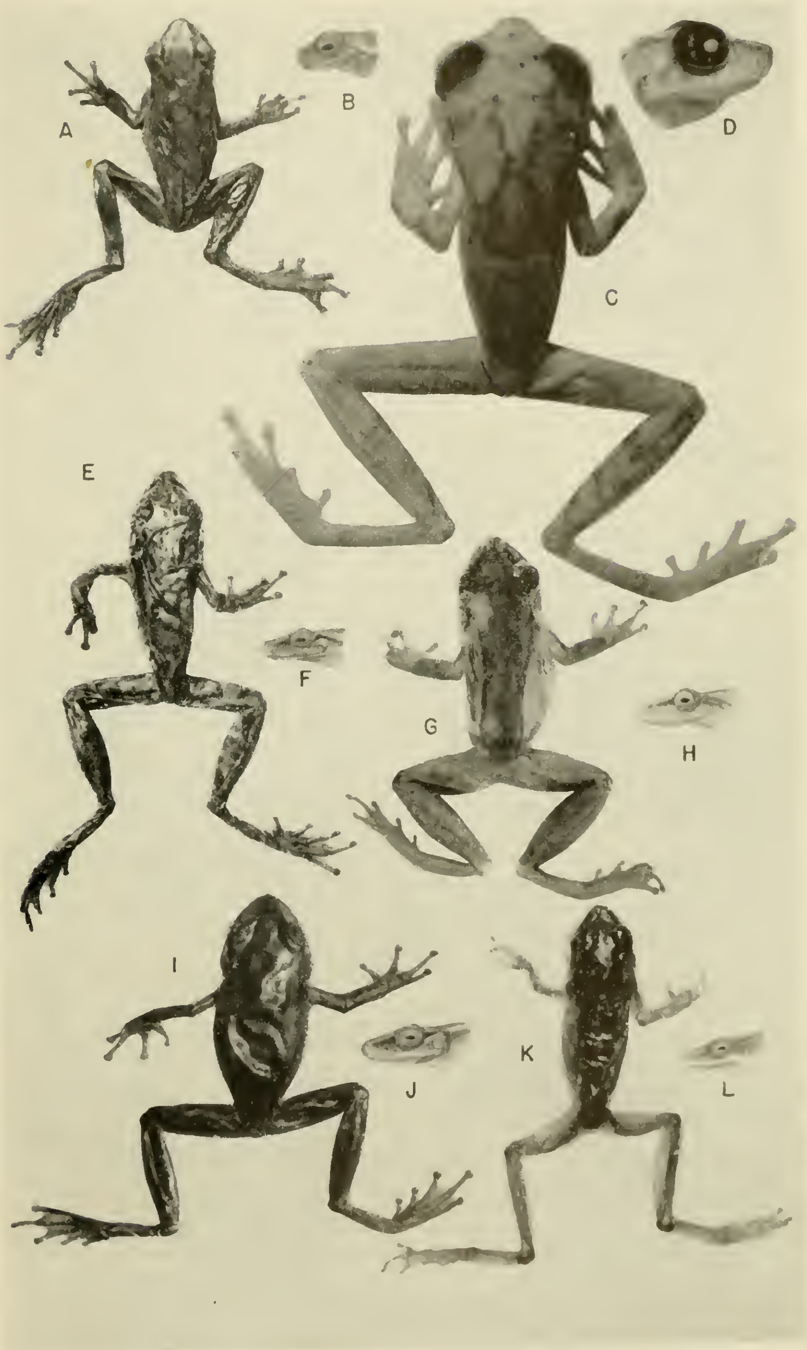
Hyla raniceps (BM 1928.1.12.30, × ⅝): A, dorsum; B, profile; C, venter. *H. bipunctata* (USNM 97275, × 1⅙): D, dorsum; E, profile. *H. decipiens* (USNM 96194, cotype; × 1⅗): F, dorsum; G, profile. *H. decipiens:* H, egg masses on leaves; I, dorsum of USNM 97642 (× 1⅜). *H. elongata* (USNM 96861, cotype; × 1⅞): J, dorsum; K, profile.



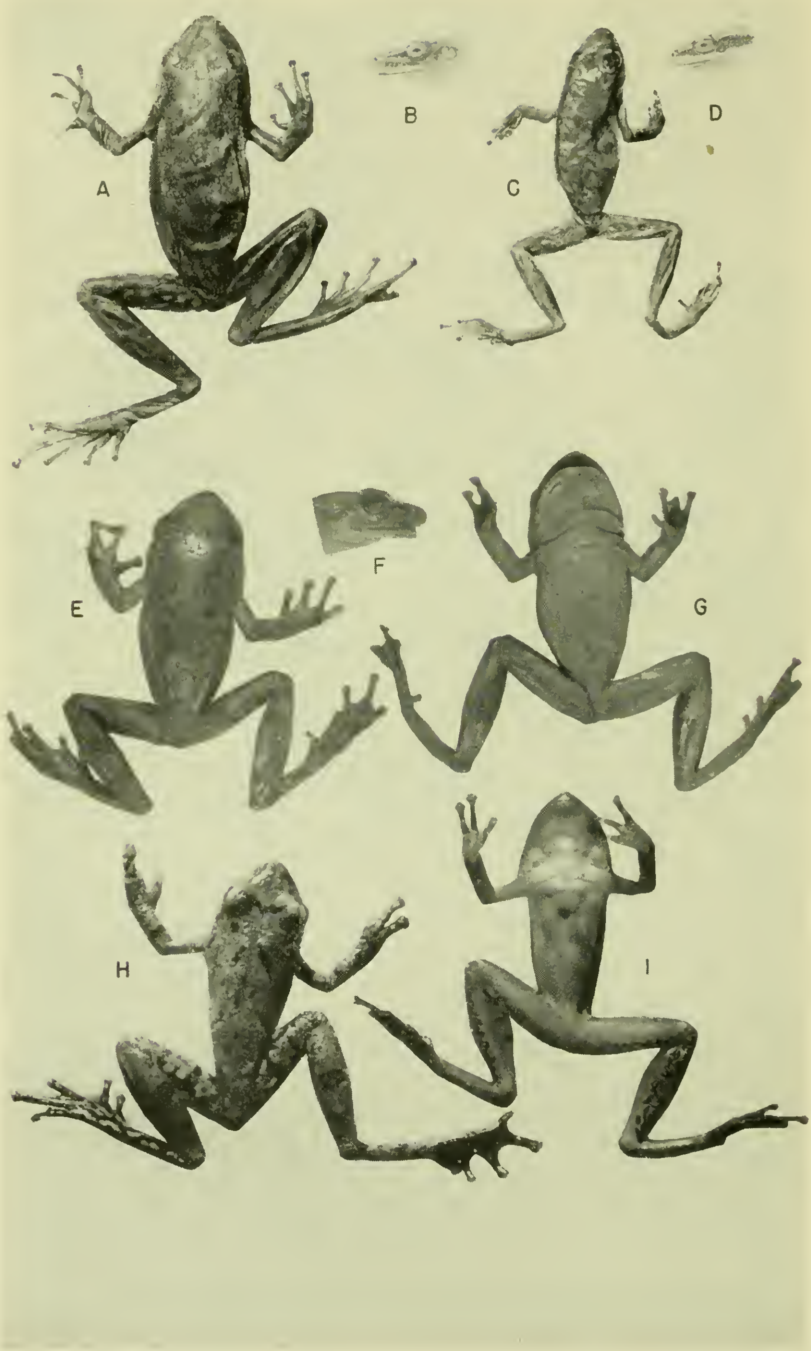
Hyla leucophyllata (USNM 97358, × $1\frac{1}{5}$): A, dorsum; B, profile; C, venter. *H. leucophyllata:* D, photograph of a living frog. *H. minuta* (ZMB 7300a, cotype; × 2): E, dorsum; F, profile; G, venter; H, dorsum of ZMB 7300b.



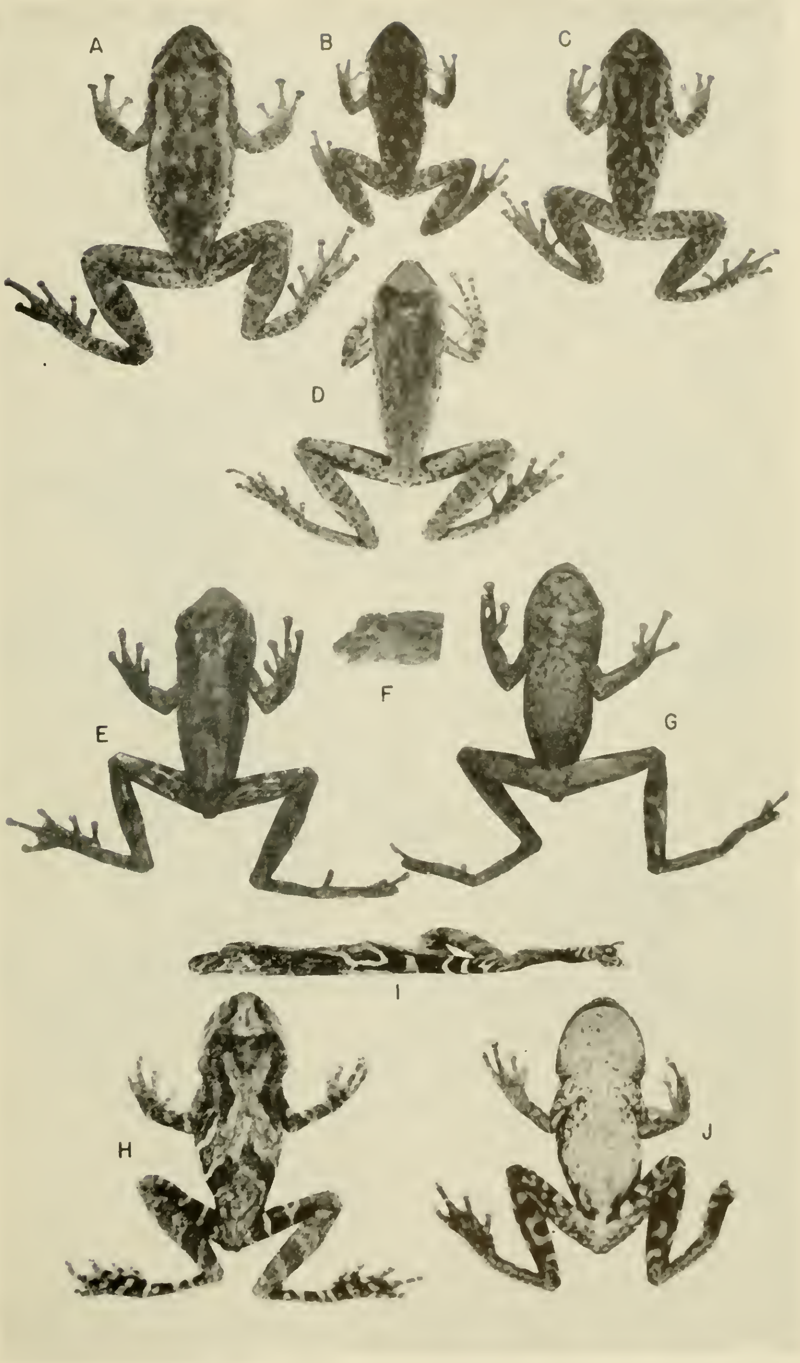
Hyla minuta (BM 88.9.21.19, cotype of *H. bivittata* Boulenger; × 2): A, dorsum; B, profile; C, venter. *H. minuta* (ANSP, cotype of *H. velata* Cope; × 1½): D, dorsum; E, profile; F, venter. *H. nana* (BM 91.3.10.18): G, dorsum; H, profile; I, venter.



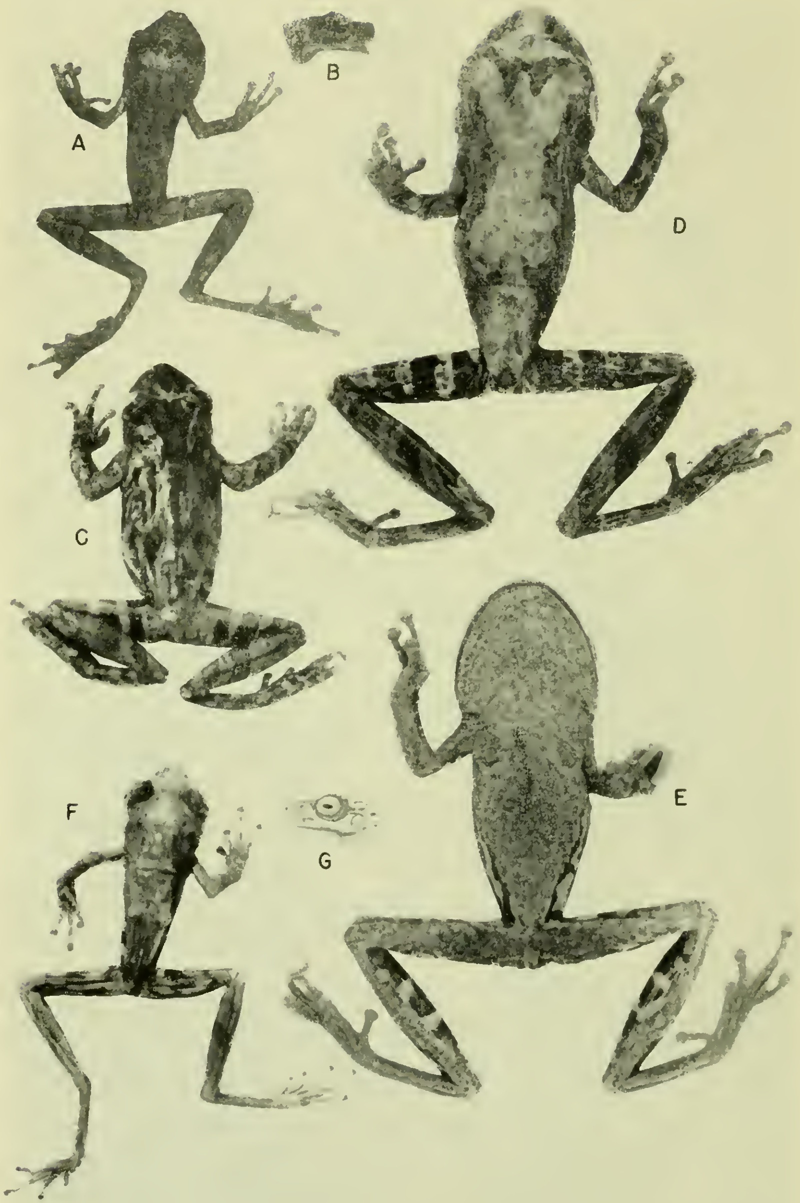
Hyla werneri (USNM 66564, × 1½): A, dorsum; B, profile. *H. werneri* (USNM 97362, × 2½): C, dorsum; D, profile. *H. crospedospila* (USNM 96932, × 1): E, dorsum; F, profile. *H. cuspidata* (USNM 97612, × 1⅕): G, dorsum; H, profile. *H. fuscomarginata* (USNM 97613, × 1⅛): I, dorsum; J, profile. *H. fuscomarginata* (USNM 96964, × 1¼): K, dorsum; L, profile.



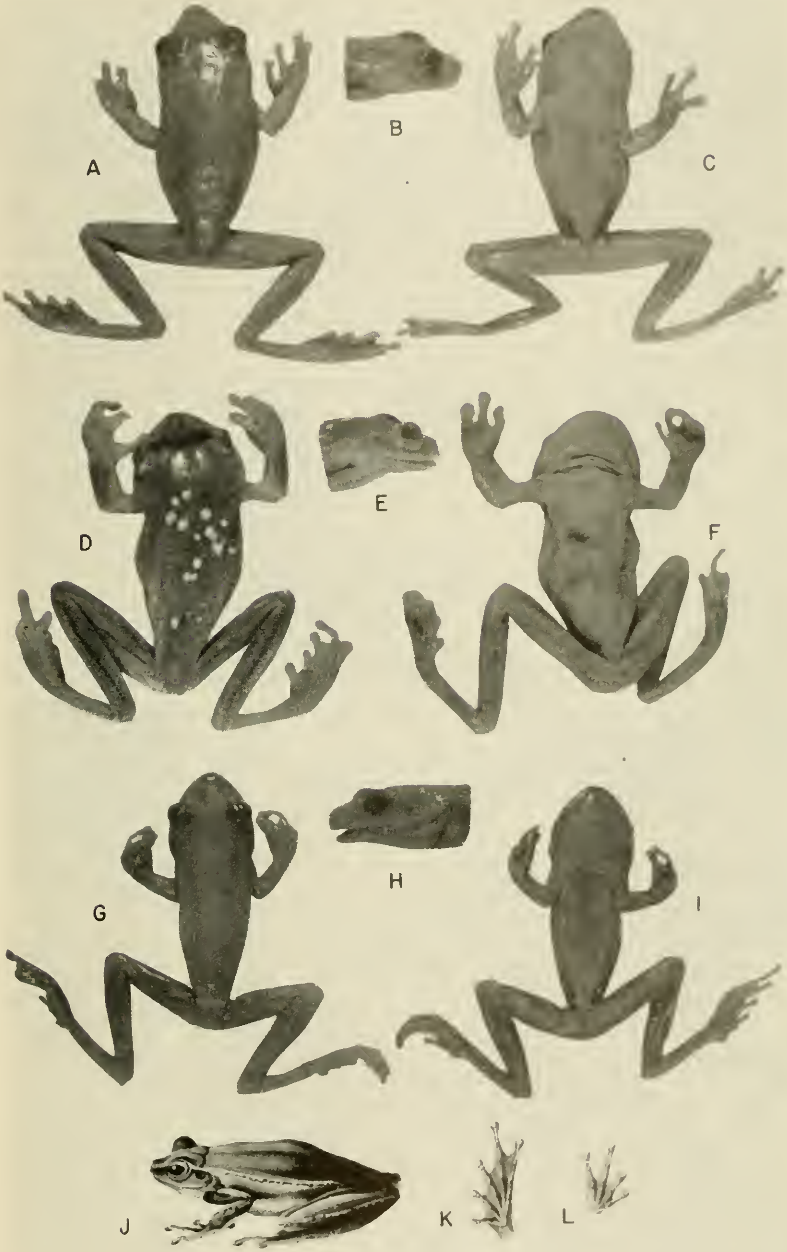
Hyla fuscovaria (USNM 96988, × 9/10): A, dorsum; B, profile. *H. parkeri* (USNM 98128, × 1¼): C, dorsum; D, profile. *H. hayii* (USNM 97776, × ⅞): E, dorsum; F, profile; G, venter. *H. hayii* (photographs from Dr. Sawaya, about × ½): H, dorsum; I, venter.



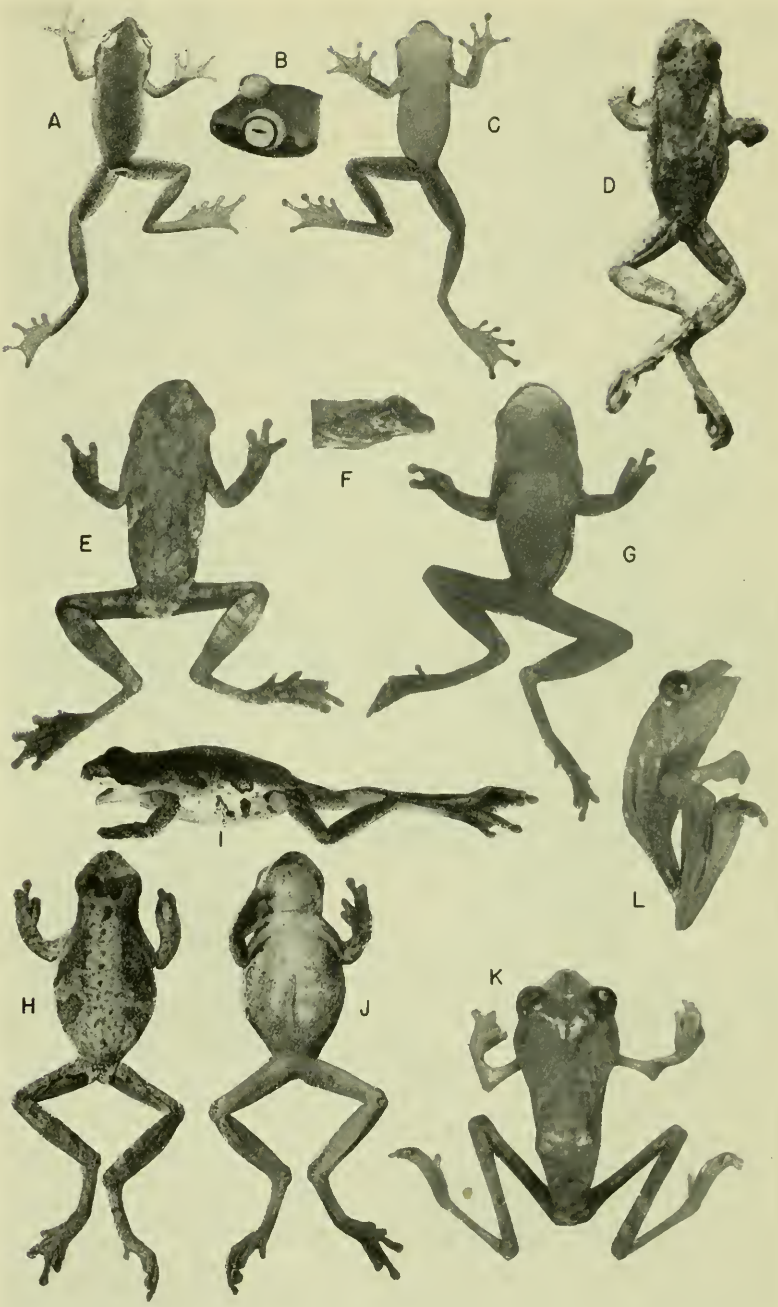
Hyla similis (photographs from Lutz Coll.): A–D, pattern variation. *H. strigilata brieni* (USNM 97816, × ⅞): E, dorsum; F, profile; G, venter. *H. s. catharinae* (BM 1947.2.12.65, cotype; × ⅚): H, dorsum; I, side view; J, venter.



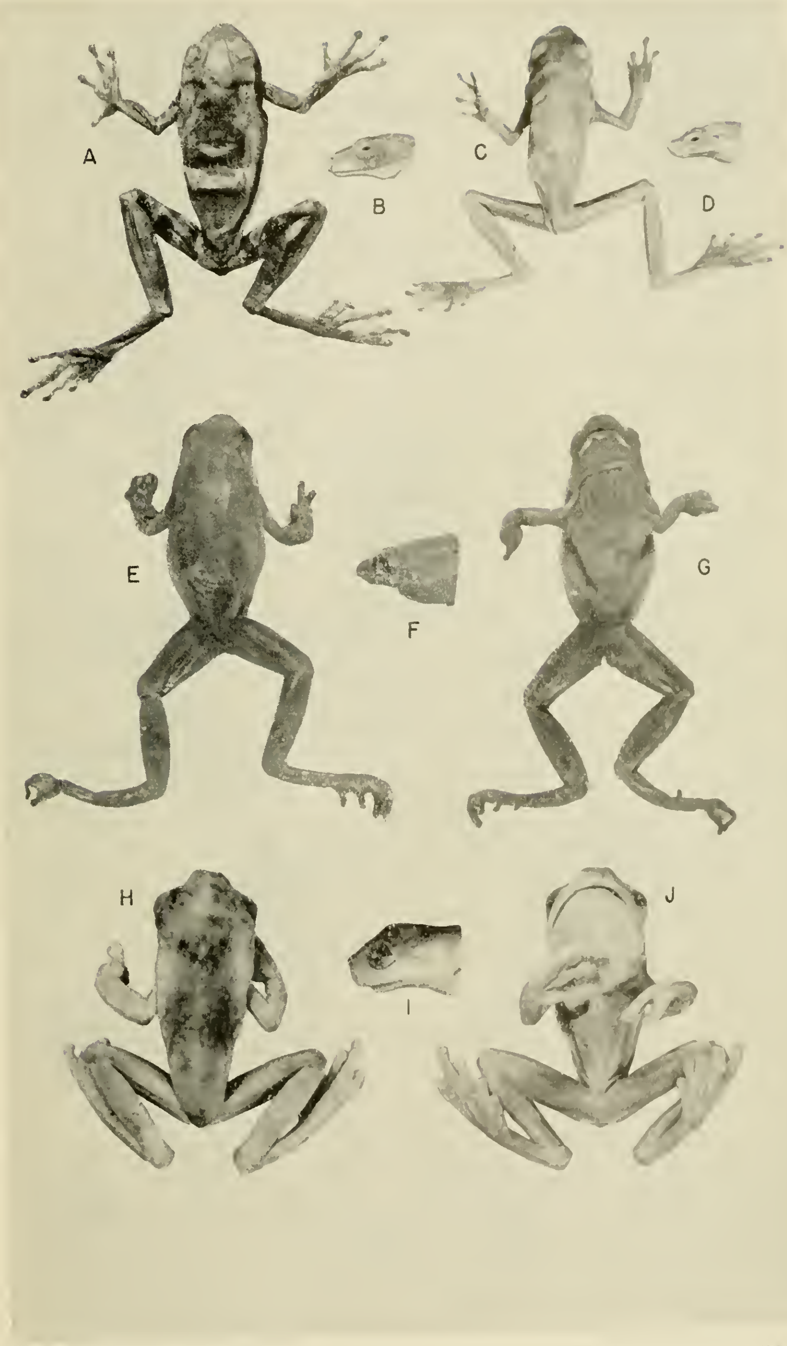
Hyla strigilata flavoguttata (USNM 121636, × ¾): A, dorsum; B, profile. *H. s. flavoguttata* (photograph from Lutz Coll.): C, dorsum. *H. s. strigilata* (ZMB 7504–77): D, dorsum; E, venter. *H. s. strigilata* (USNM 96450, × 1⅛): F, dorsum; G, profile.



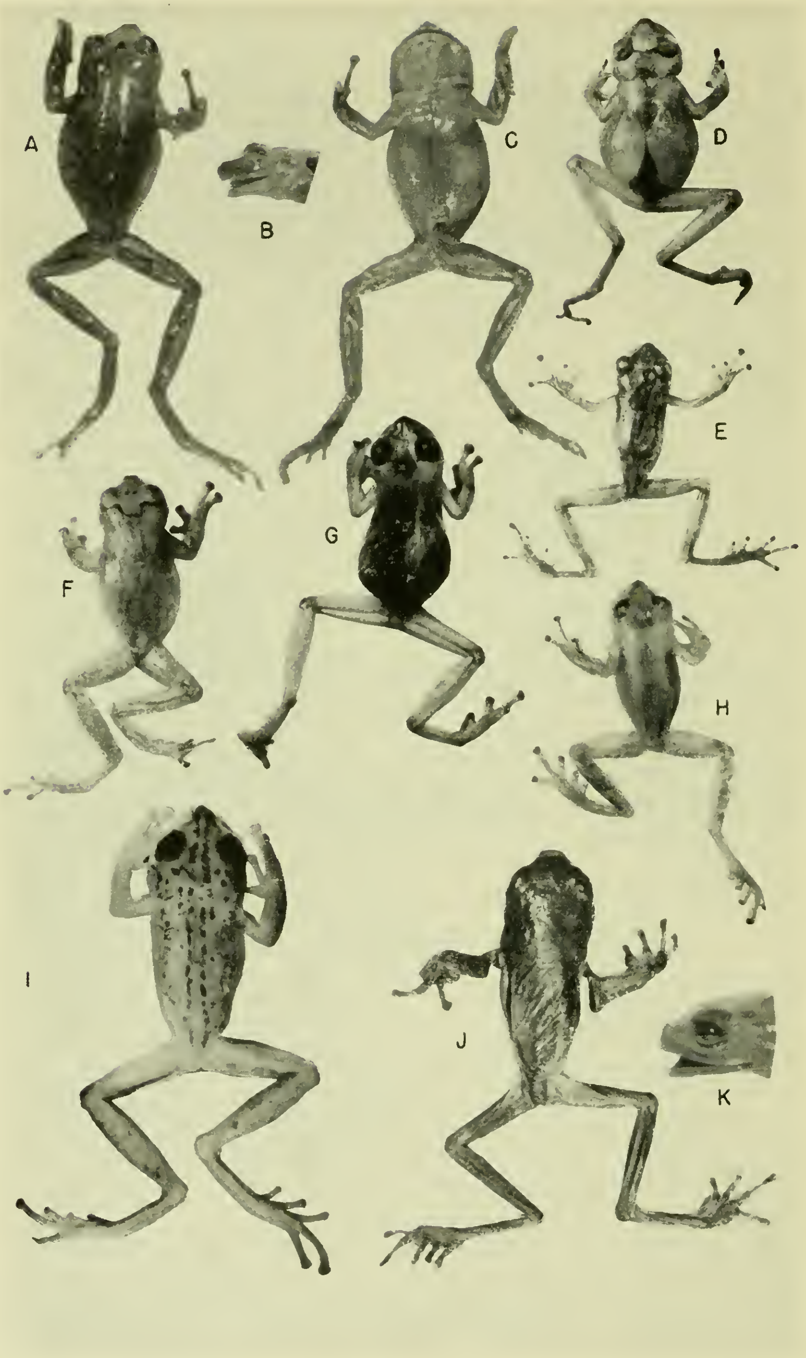
Hyla albofrenata (USNM 96340, × $\frac{7}{8}$): A, dorsum; B, profile; C, venter. *H. albomarginata* (USNM 97244, × $\frac{2}{3}$): D, dorsum; E, profile; F, venter. *H. albosignata* (USNM 96781, × $\frac{3}{4}$): G, dorsum; H, profile; I, venter. *H. prasina* (after Burmeister): J, side view; K, foot; L, hand.



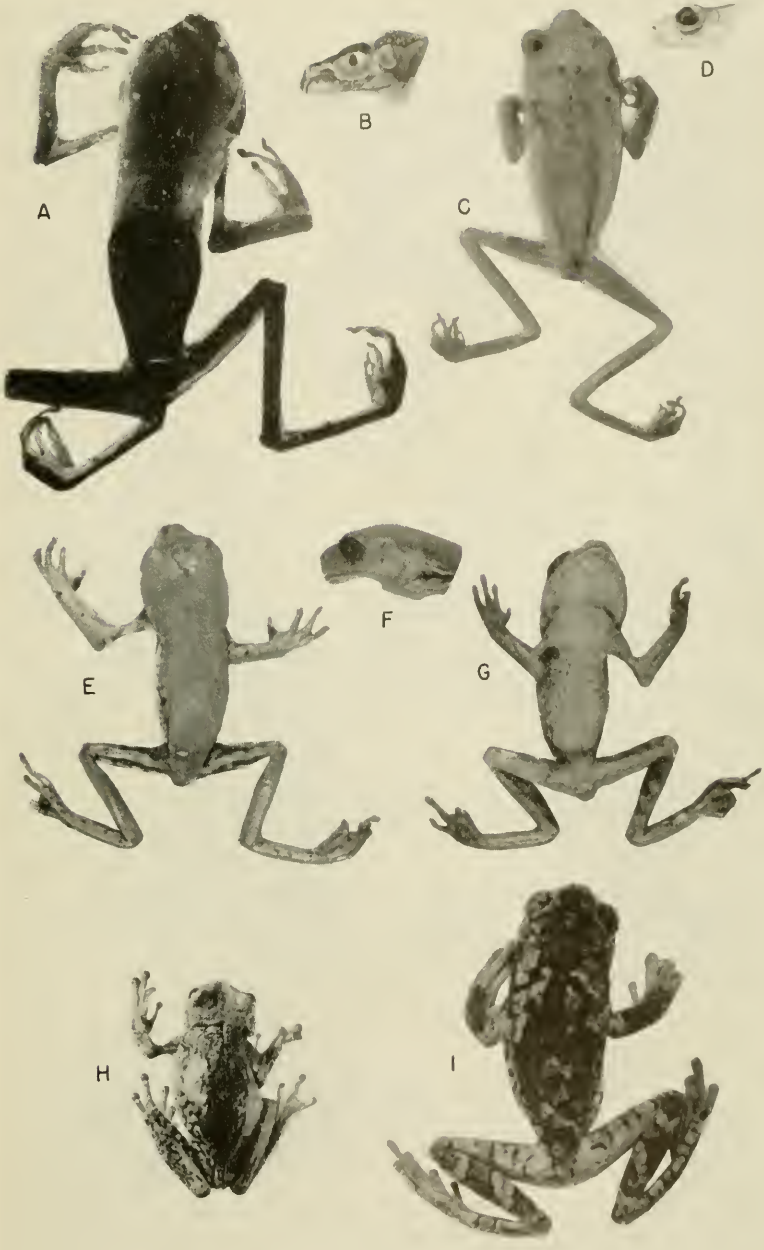
Hyla musica (after B. Lutz, about × ½): A, dorsum; B, head; C, venter. *Hyla marmorata senicula* (UZMK 37, type of *H. warmingi* Reinhardt): D, dorsum. *H. m. senicula* (USNM 96498, × ½): E, dorsum; F, profile; G, venter. *H. microps* (ZMB 7472, type; × 1): H, dorsum; I, side view; J, venter. *H. geographica punctatissima* (USNM 97719, × 7/10): K, dorsum; L, side view.



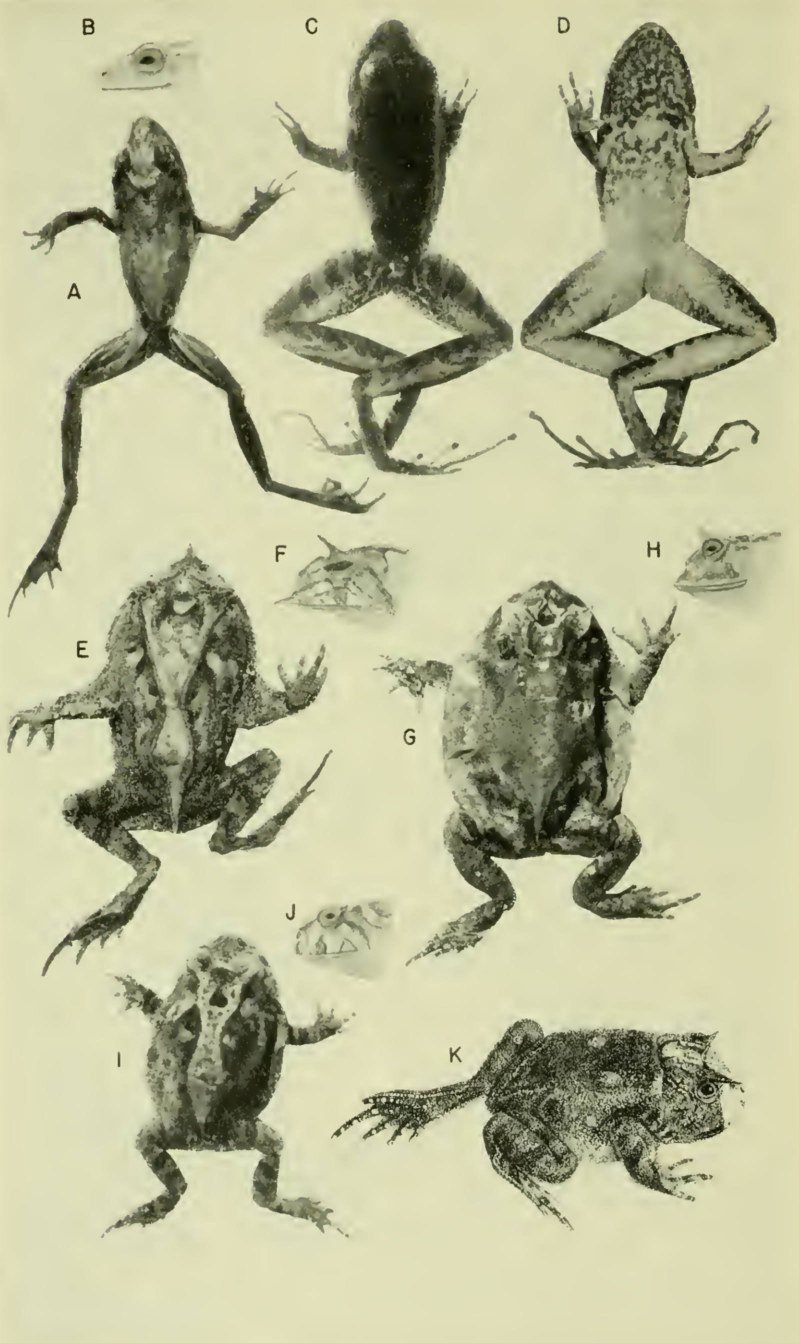
Hyla anceps (USNM 96441, × 7/8): A, dorsum; B, profile. *H. aurantiaca planicola* (USNM 97619, × 1⅙): C, dorsum; D, profile. *H. a. orophila* (USNM 96692, × 1): E, dorsum; F, profile; G, venter. *H. a. orophila* (BM 95.3.6.5, cotype of *H. parvula* Boulenger; × 1 4/5): H, dorsum; I, profile; J, venter.



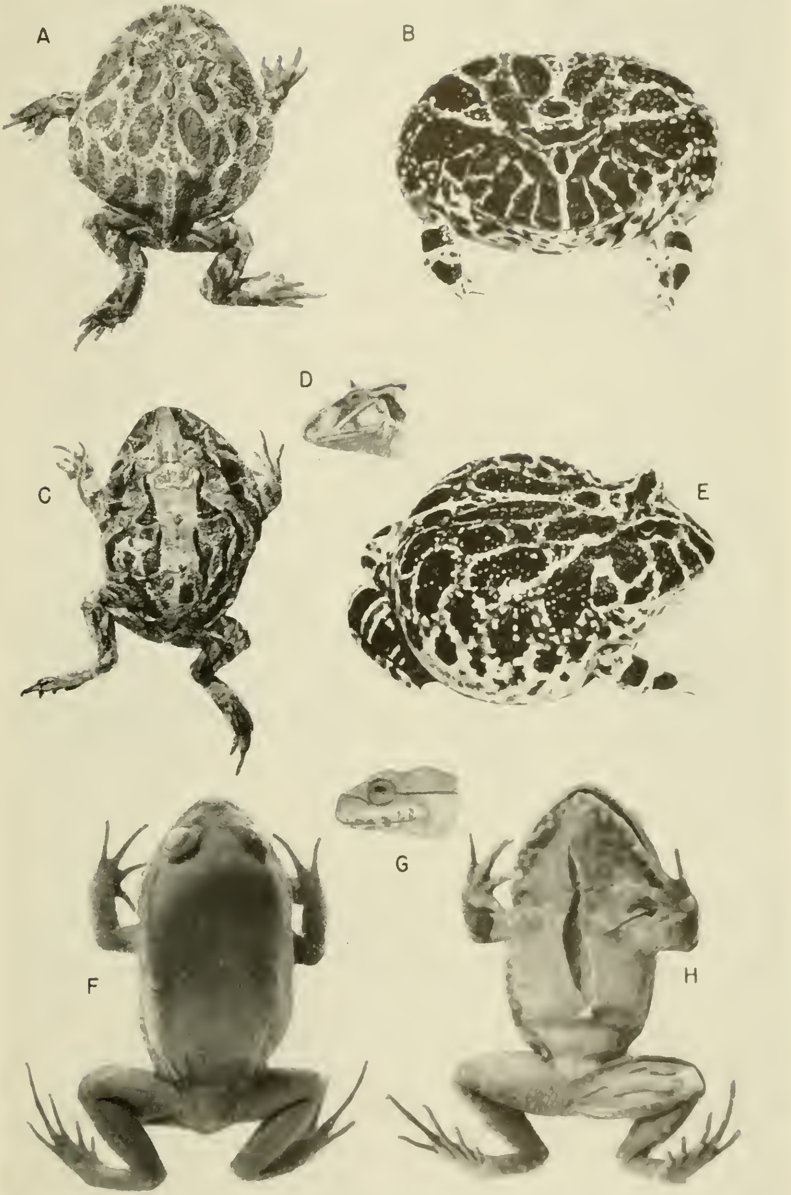
Hyla goeldii (USNM 96665, × 1): A, dorsum; B, profile; C, venter. *H. goeldii* (photographs from Lutz Coll.): D–H, pattern variation. *Nototheca fissilis* (after Bokermann): I, dorsum. *Phyllomedusa appendiculata* (USNM 97147, × 1): J, dorsum; K, profile.



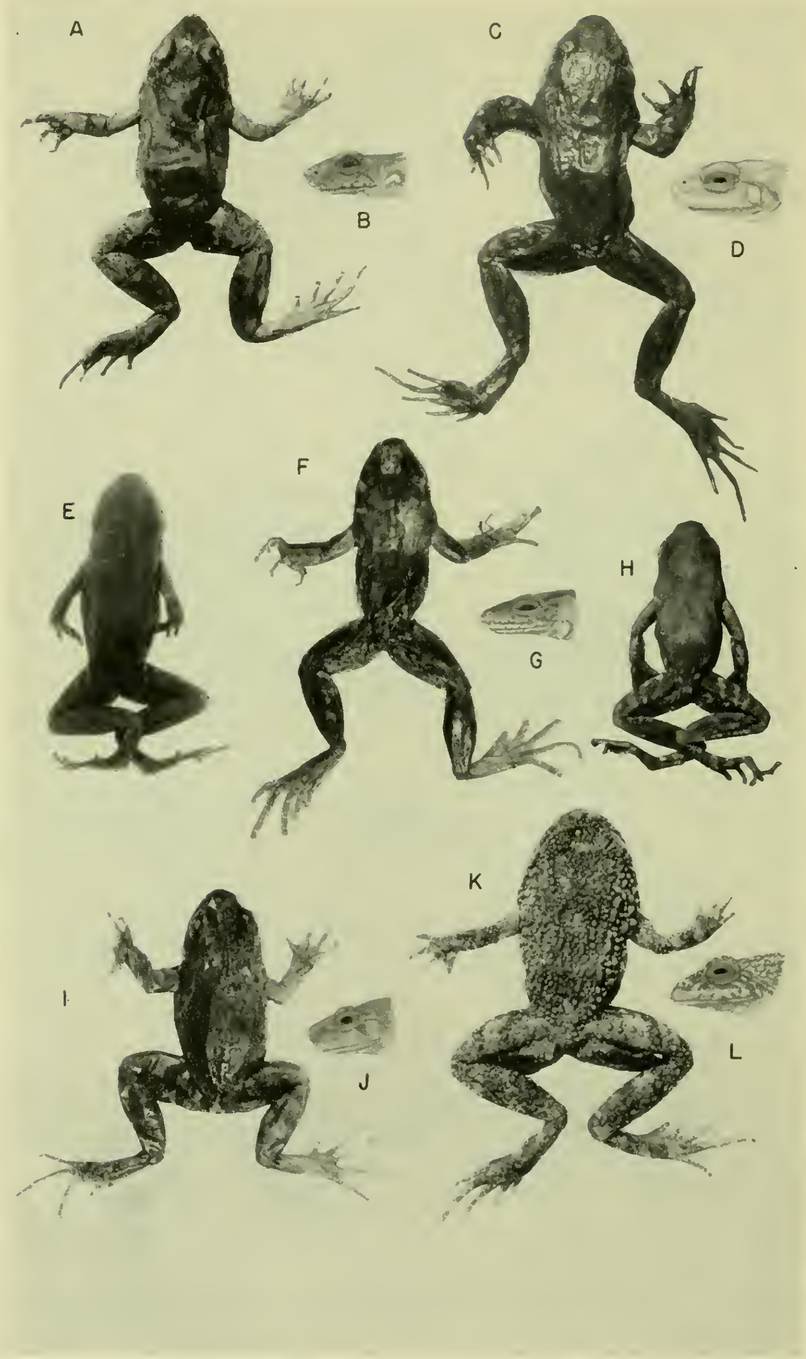
Phyllomedusa burmeisteri (USNM 96440, × ⅔): A, dorsum; B, profile. *P. guttata* (USNM 96338, cotype, × 1): C, dorsum; D, profile. *P. rohdei* (USNM 99110, × 1): E, dorsum; F, profile; G, venter. *Trachycephalus nigromaculatus* (photographs from Lutz Coll.): H and I, pattern variation.



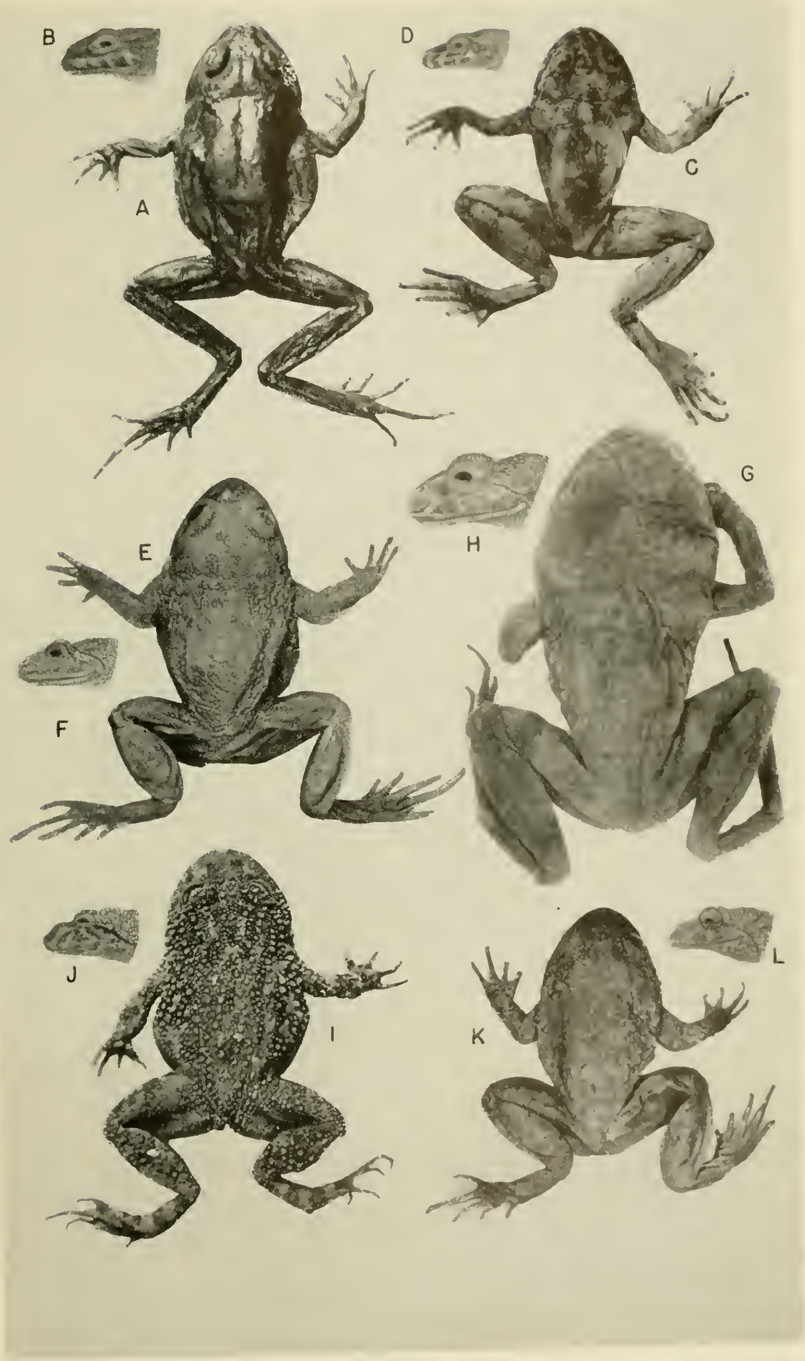
Basanitia bolbodactyla (USNM 96543, × 2): A, dorsum; B, profile. *B. bolbodactyla* (photographs from Lutz Coll., × 1½): C, dorsum; D, venter. *Ceratophrys appendiculata* (USNM 121320, × 1): E, dorsum; F, profile. *C. boiei* (USNM 97766, × ½): G, dorsum; H, profile). *C. cristiceps* (USNM 121356, × 1): I, dorsum; J, profile. *C. fryi* (after Boulenger): K, side view.



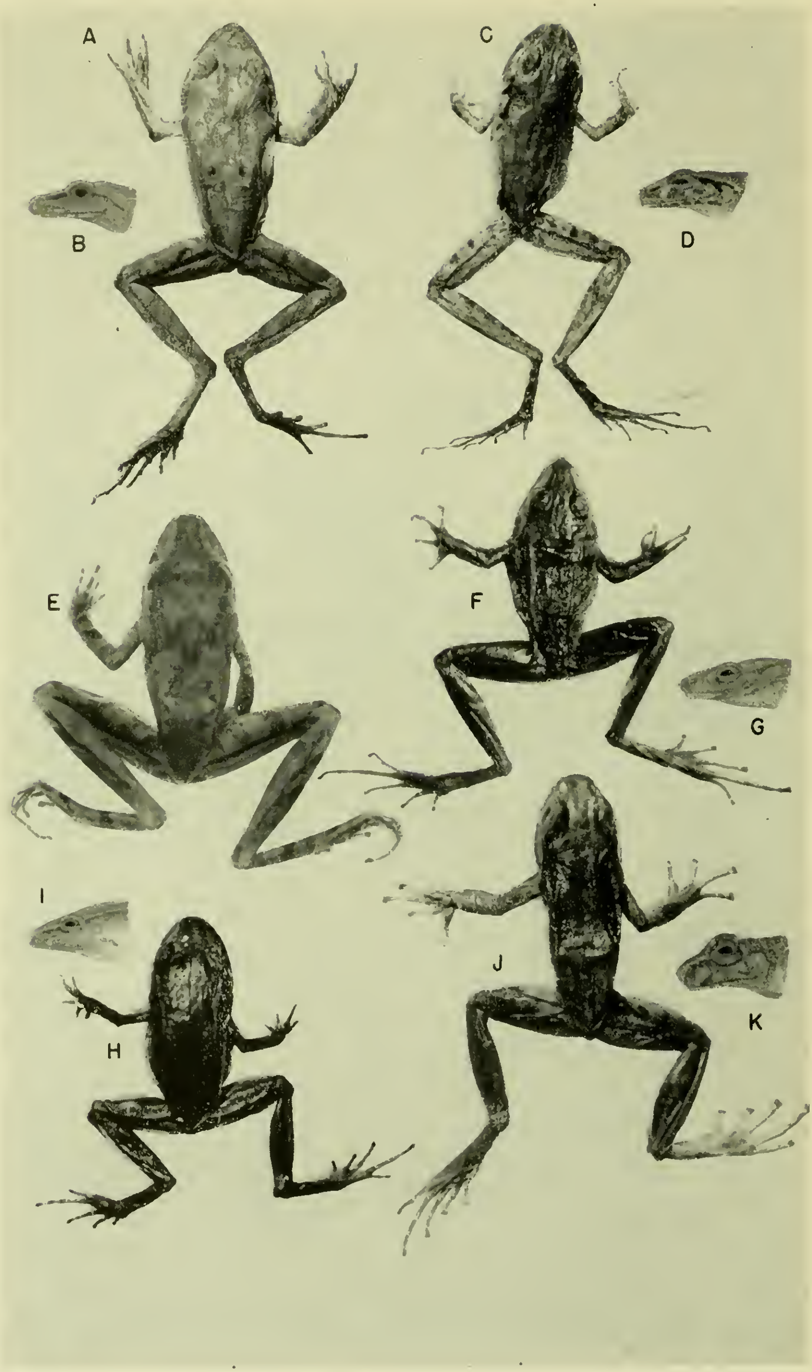
Ceratophrys ornata (USNM 113836, × $^{7}/_{20}$): A, dorsum. *C. ornata* (photograph by Philadelphia Zoological Gardens): B, front view; E, side view. *C. varia* (USNM 115606, × $^{3}/_{10}$) C, dorsum; D, profile. *Craspedoglossa steinegeri* (USNM 52608, type, × 1): F, dorsum; G, profile; H, venter.



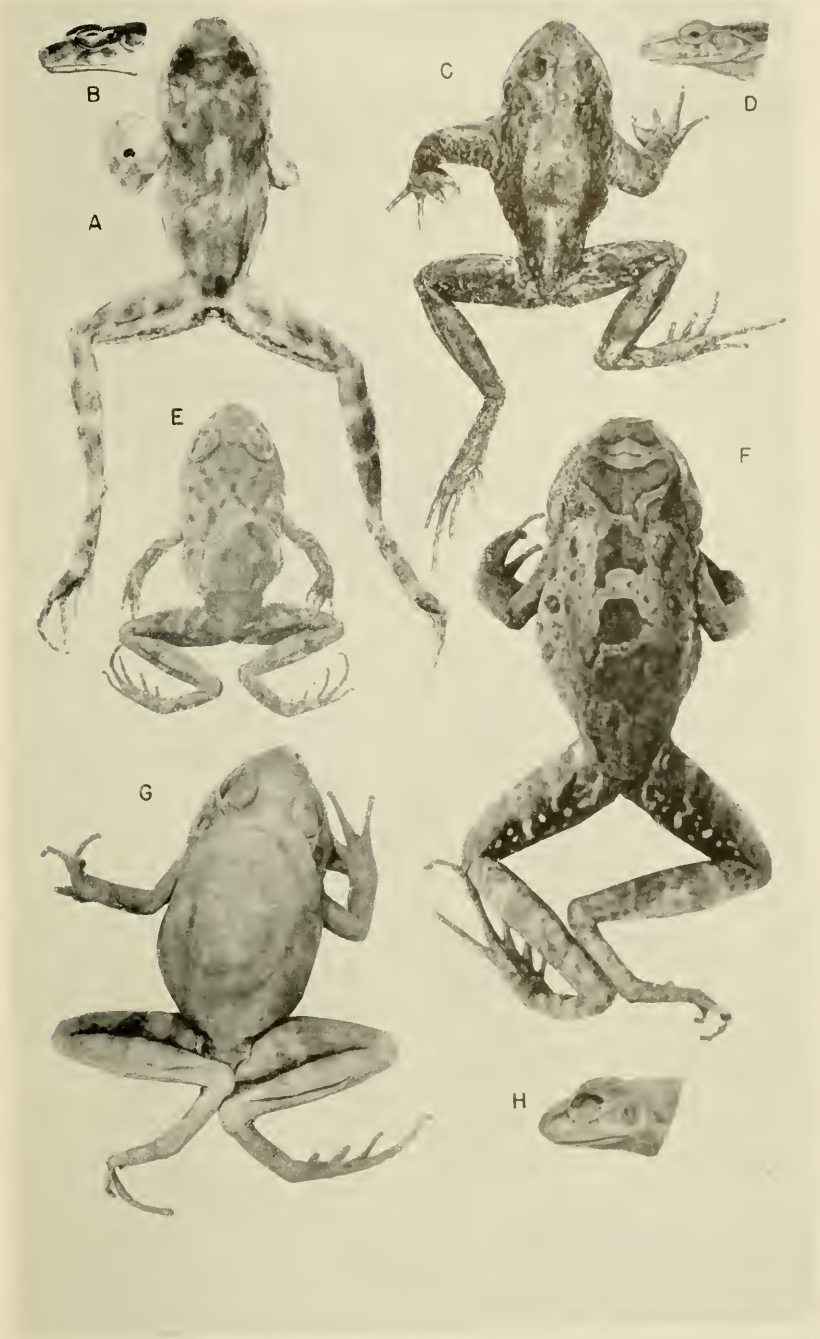
Crossodactylus aeneus (USNM 97692, × 1): A, dorsum; B, profile. *C. dispar* (USNM 96739, × 1¼): C, dorsum; D, profile. *C. dispar* (MRHN IG 9404, Reg. 80, type of *Calamobates boulengeri* de Witte; × 1): E, dorsum. *C. gaudichaudii* (USNM 97496, × 1): F, dorsum; G, profile. *C. gaudichaudii* (MRHN IG 9404, Reg. 79, type of *Phyllobates brasiliensis* de Witte; × 1): H, dorsum. *C. trachystoma* (USNM 98017, × 1): I, dorsum; J, profile. *Cycloramphus asper* (USNM 97841, × 1): K, dorsum; L, profile.



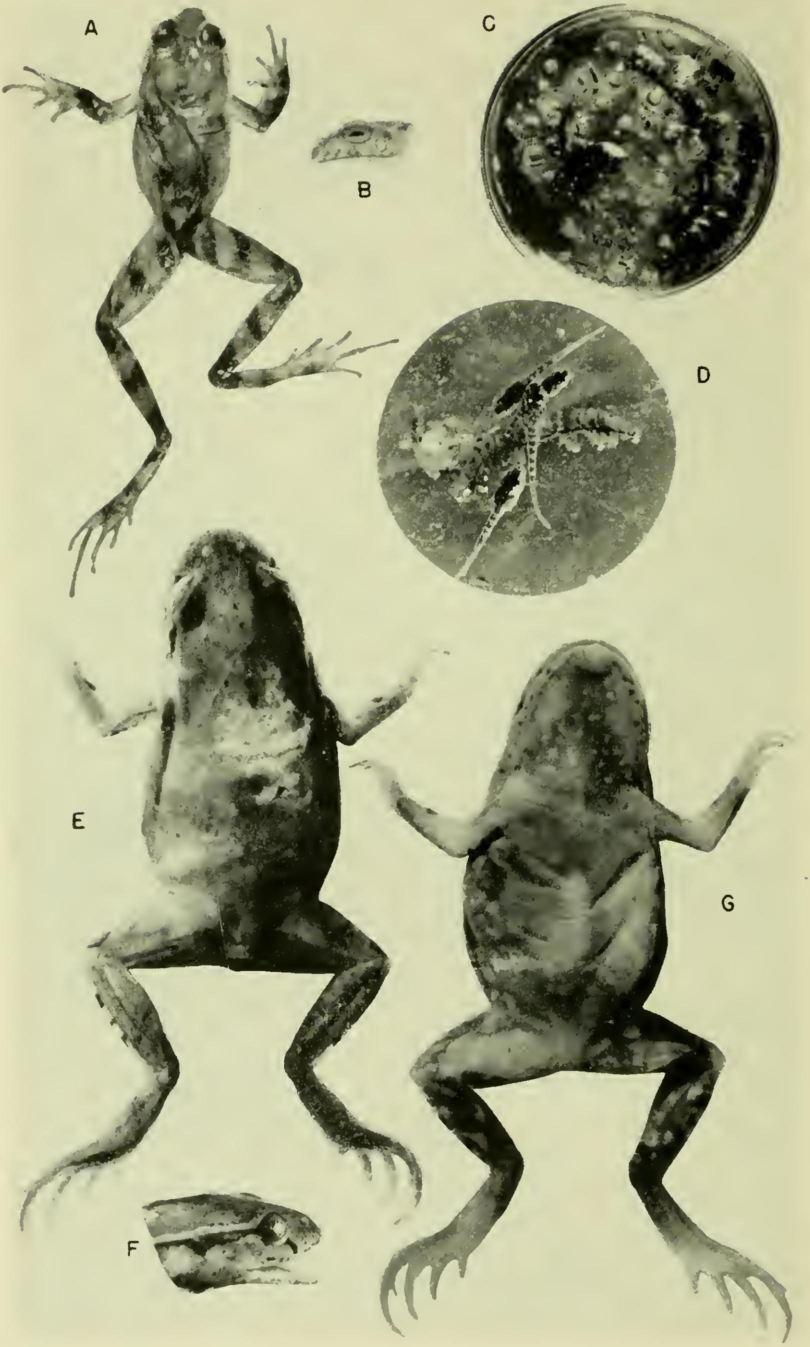
Cycloramphus eleutherodactylus (USNM 98084, $\times \frac{5}{6}$): A, dorsum; B, profile. *C. fulginosus* (USNM 96264, $\times 1$): C, dorsum; D, profile. *C. granulosus* (USNM 96742, cotype, $\times \frac{7}{8}$): E, dorsum; F, profile. *C. neglectus* (USNM 97179, cotype, $\times 1\frac{1}{2}$): G, dorsum; H, profile. *C. ohausi* (USNM 118998, $\times 1$): I, dorsum; J, profile. *C. umbrinus* (USNM 81144, $\times \frac{2}{3}$): K, dorsum; L, profile.



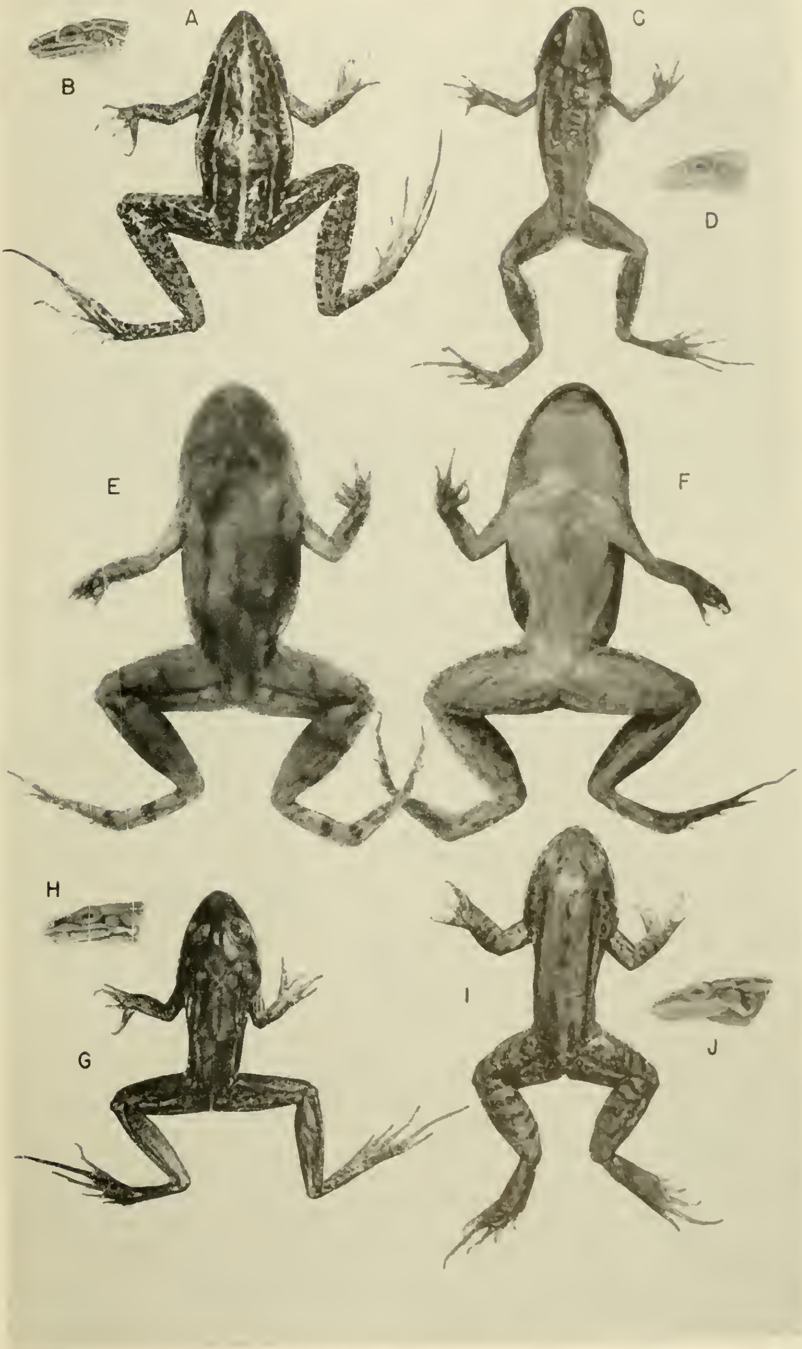
Eleutherodactylus binotatus (USNM 97403, × ⅗): A, dorsum; B, profile. *E. guentheri* (USNM 97404, × ⅘): C, dorsum; D, profile). *E. guentheri* (NHMW 1874, type): E, dorsum. *E. nasutus* (USNM 96469, cotype, × ⅞): F, dorsum; G, profile. *E. parvus* (USNM 96807, × 1⅜): H, dorsum; I, profile. *Elosia nasus* (USNM 96258, × 1): J, dorsum; K, profile.



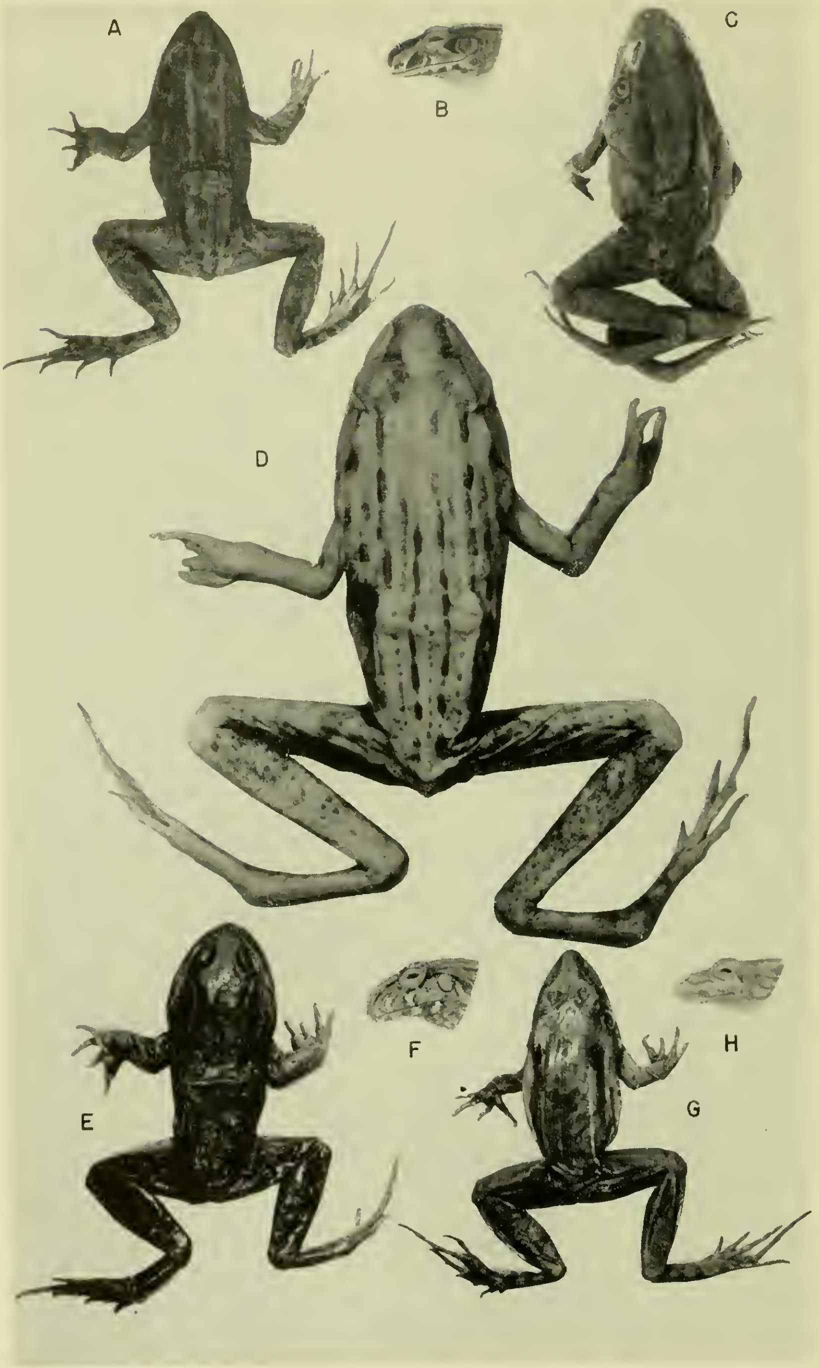
Eupsophus lutzi (USNM 97622, type, × 1½): A, dorsum; B, profile. *E. miliaris* (USNM 97765, × ½): C, dorsum; D, profile. *E. miliaris* (NHMW 1857/59, type of *E. fuliginosus* Fitzinger): E, dorsum. *E. miliaris* (MRHN IG 9308, Reg. 49, type of *Hylodes brieni* de Witte): F, dorsum. *E. miliaris* (MP, type of *Hylodes abbreviata taophora* Miranda-Ribeiro): G, dorsum; H, profile.



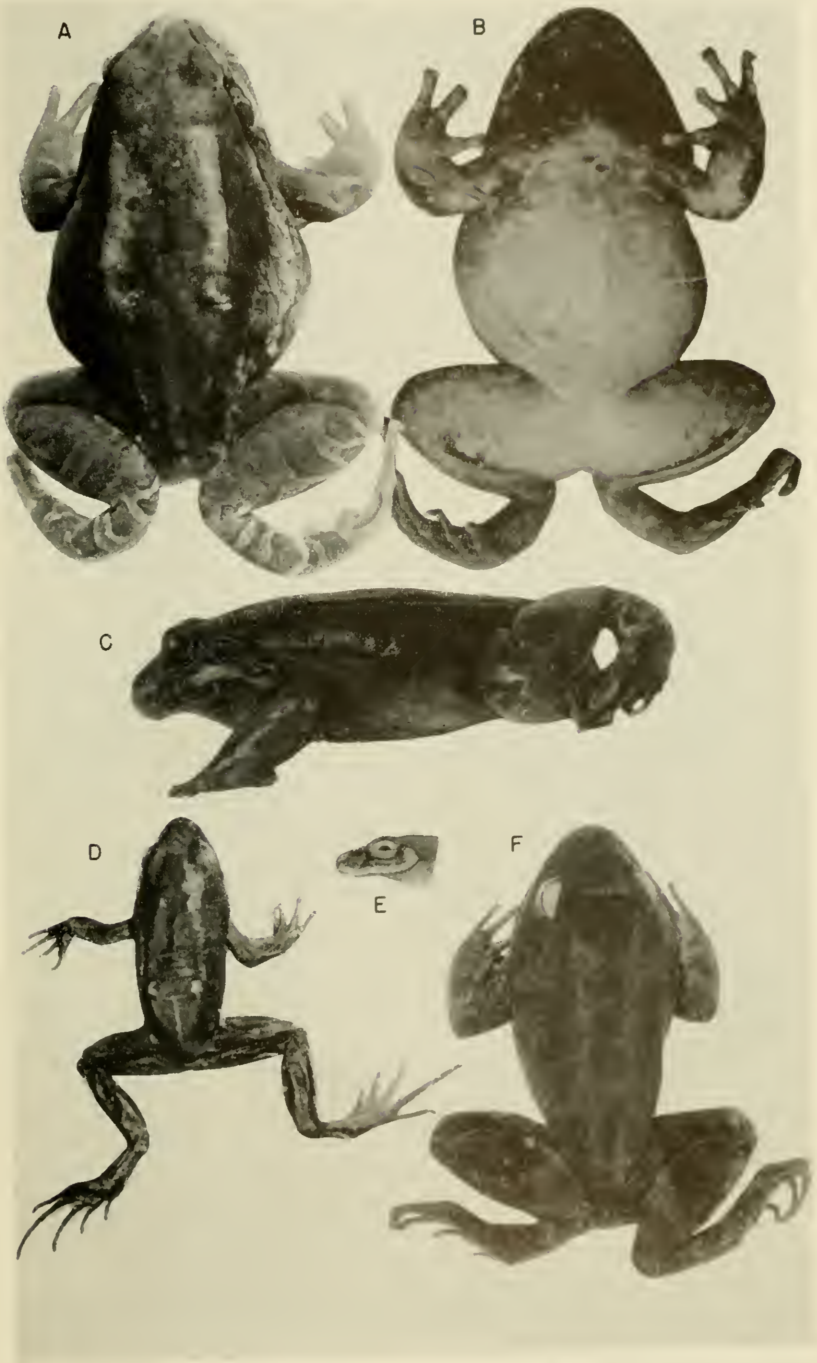
Eupsophus petropolitanus (USNM 97648, × 1½): A, dorsum; B, profile. *E. petropolitanus* (photographed from life): C, eggs; D, tadpoles. *Leptodactylus gaigeae* (USNM 96759, type, × 3): E, dorsum; F, profile; G, venter.



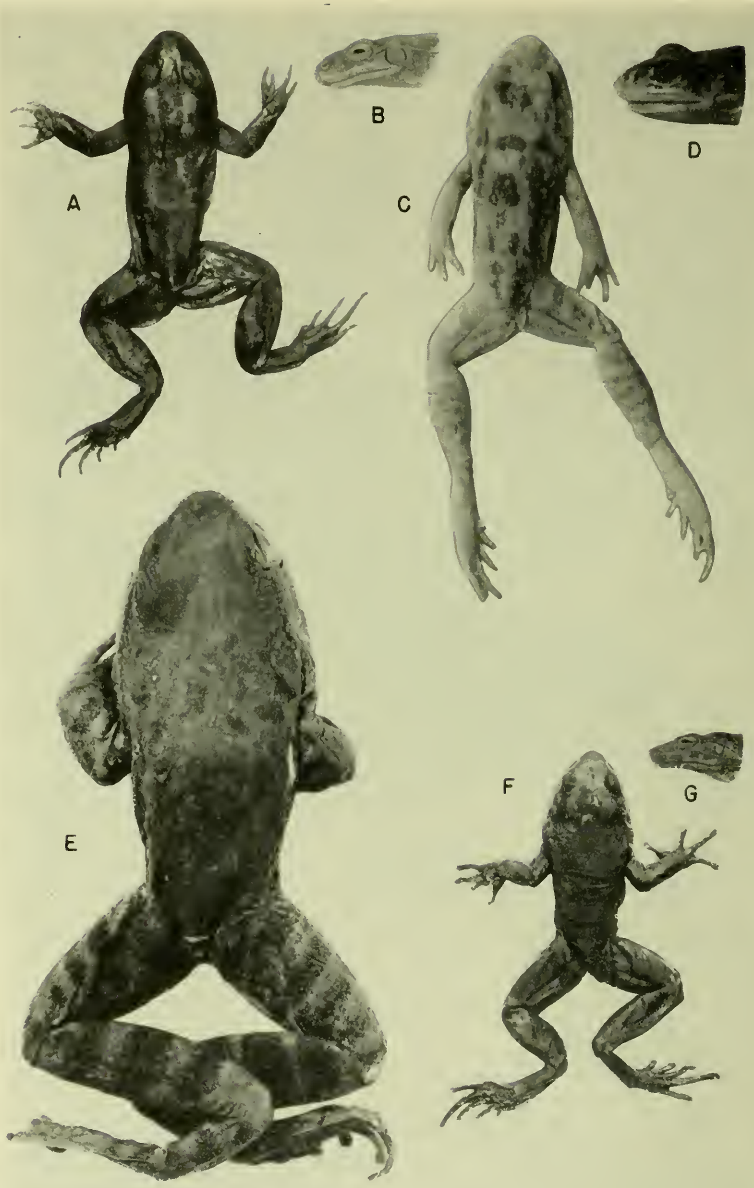
Leptodactylus gracilis (USNM 96614, $\times\, ^{7}/_{10}$): A, dorsum; B, profile. *L. marmoratus* (USNM 96942, $\times\, 1^{1}/_{4}$): C, dorsum; D, profile. *L. marmoratus* (USNM 81132, cotype of *L. trivittatus* A. Lutz, × 2): E, dorsum; F, venter. *L. mystaceus* (USNM 99120, $\times\, ^{3}/_{4}$): G, dorsum; H, profile. *L. mystacinus* (USNM 99121, $\times\, ^{2}/_{3}$): I, dorsum; J, profile.



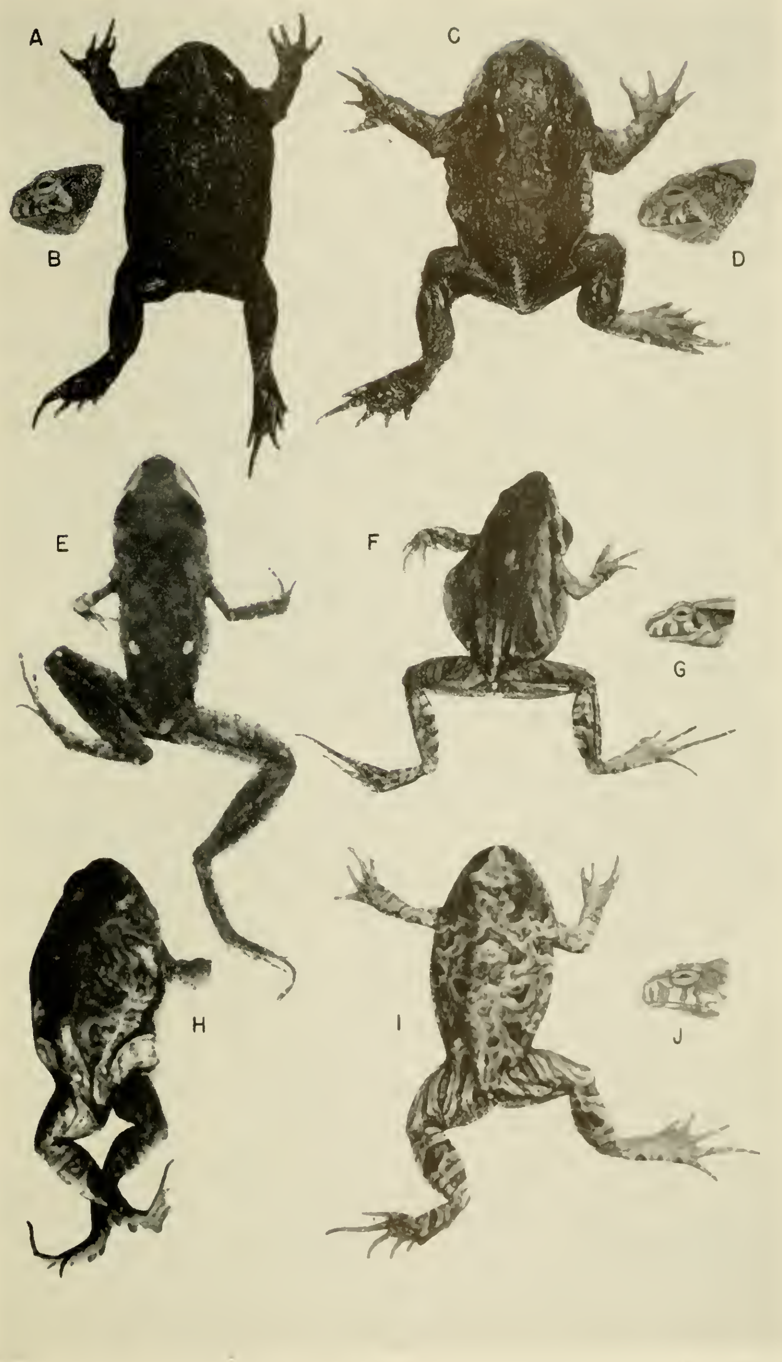
Leptodactylus ocellatus (USNM 98261, × ½): A, dorsum; B, profile. *L. ocellatus* (USNM 7389a, cotype of *L. caliginosus* Girard; × ½): C, dorsum. *L. ocellatus* (MP 448, type of *L. macrosternum* Miranda-Ribeiro; × 1): D, dorsum. *L. pentadactylus labyrinthicus* (USNM 121286, × ¼): F, dorsum; F. profile. *L. sibilatrix* (USNM 98271, × ⅞): G, dorsum; H, profile.



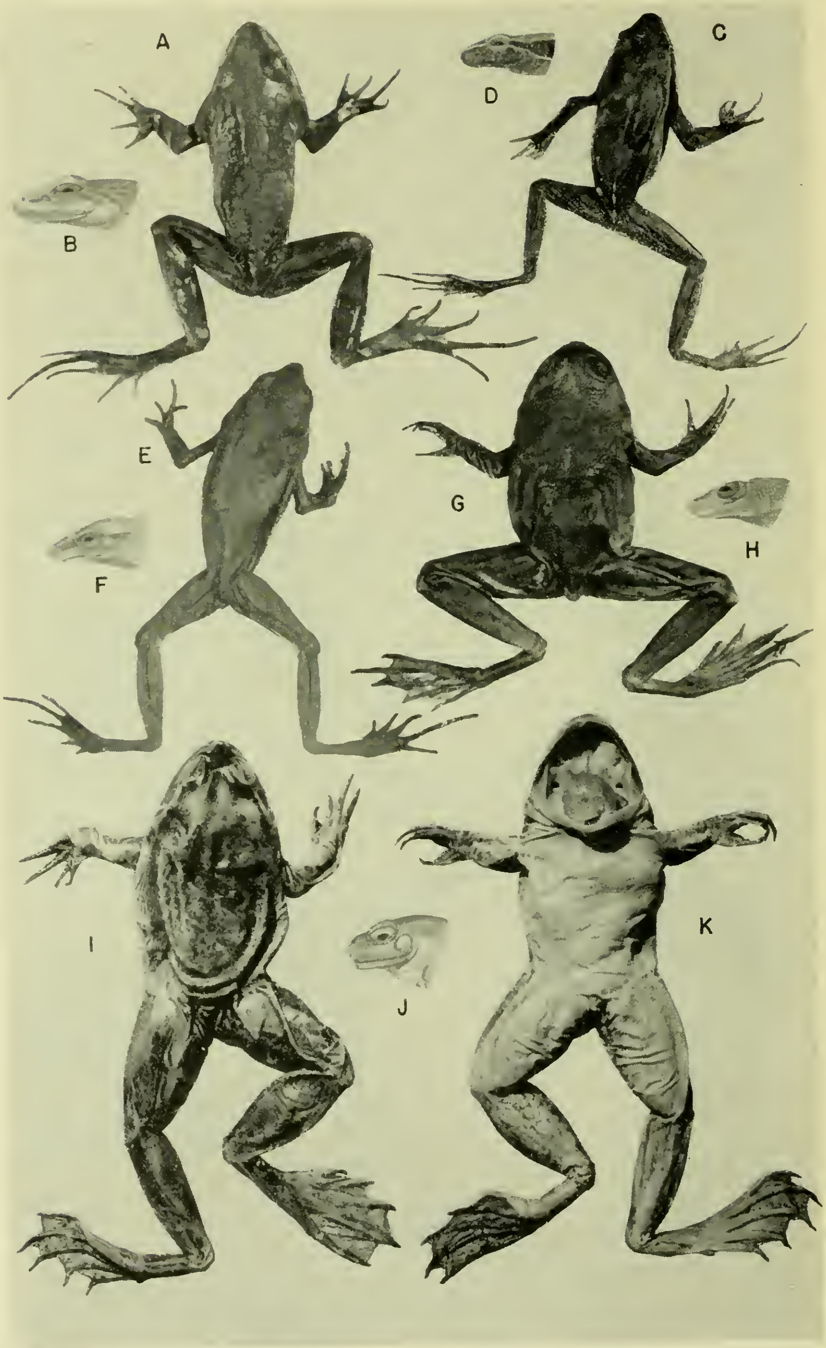
Leptodactylus pentadactylus flavopictus (Lutz Coll., type; × $^{9}/_{20}$): A, dorsum; B, venter; C, side view. *L. podicipinus* (USNM 98801, × 1): D, dorsum; E, profile. *L. podicipinus* (USNM 81130, cotype of *L. natalensis* A. Lutz; × 1½): F, dorsum.



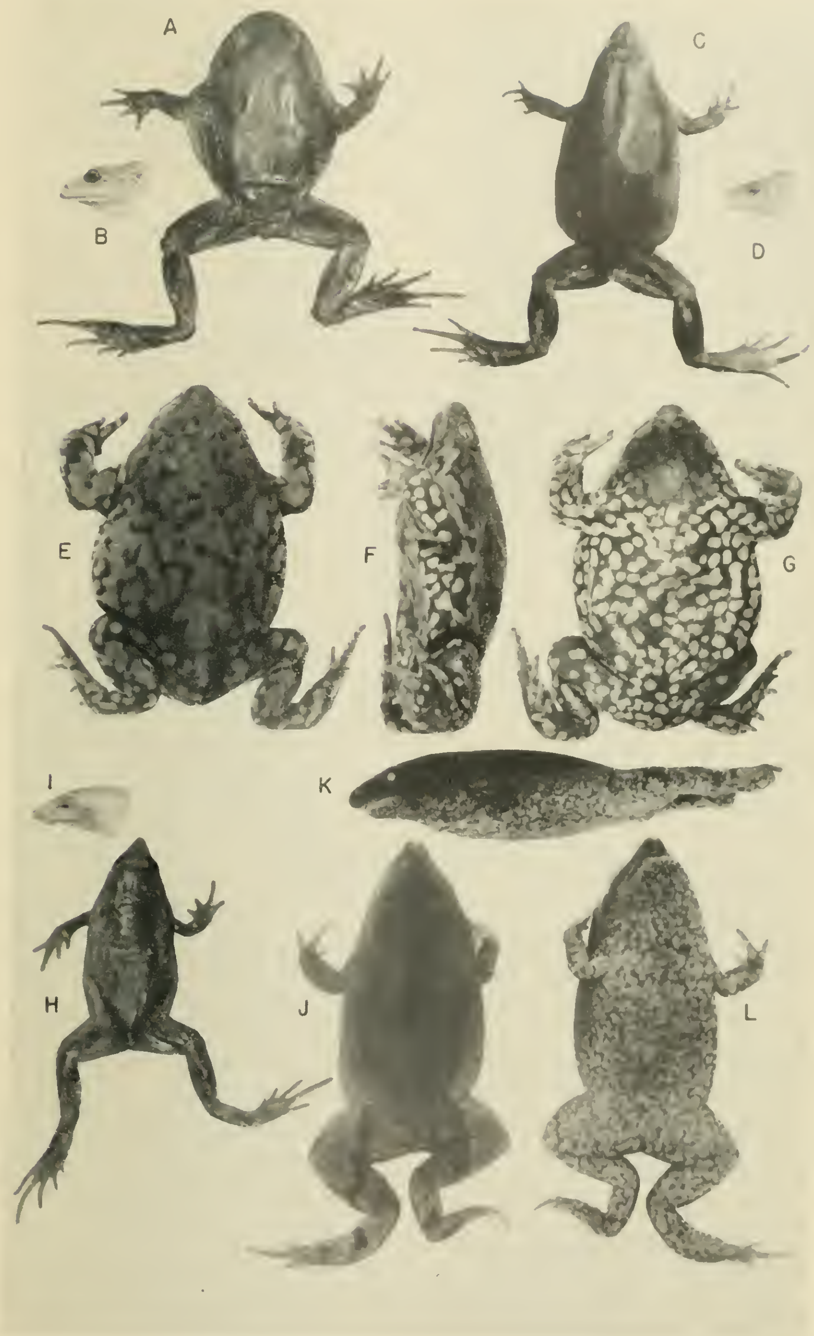
Leptodactylus troglodytes (USNM 97048, × 7/10): A, dorsum; B, profile. *L. troglodytes* (photograph from Lutz Coll.); C, dorsum; D, profile. *Megaelosia goeldii* (MRHN IG 9308, reg. 74, type of *Elosia massarti* de Witte; × 3/4): E, dorsum. *M. goeldii* (USNM 96763, × 3/10): F, dorsum; G, profile.



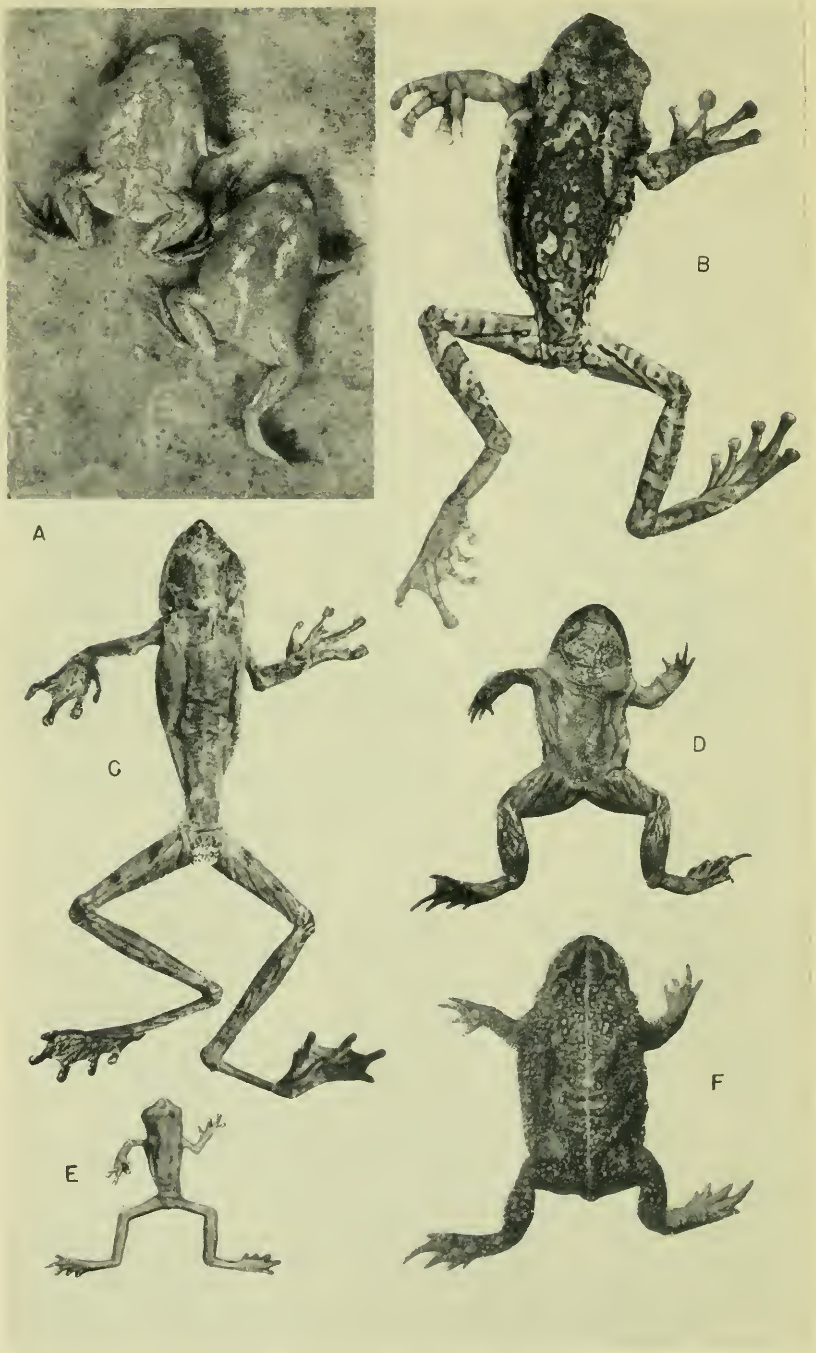
Odontophrynus americanus (USNM 123400, × ¾): A, dorsum; B, profile. *O. cultripes* (USNM 97893, × ⅝): C, dorsum; D, profile. *Phrynanodus nanus* (NHMW, type; × 2¾): E, dorsum. *Physalaemus cuvieri* (USNM 129186, × 1): F, dorsum; G, profile. *P. fuscomaculatus* (UZMK 23, × 1): H, dorsum. *P. fuscomaculatus* (USNM 98275, × 1): I, dorsum; J, profile,



Physalaemus gracilis (USNM 96756, × 1⅖): A, dorsum; B, profile. *P. olfersi* (USNM 96636, × 9⁄10): C, dorsum; D, profile. *P. signiferus* (USNM 96840, × 1½): E, dorsum; F, profile. *Pseudis bolbodactyla* (USNM 97022, cotype; × ¾): G, dorsum; H, profile. *P. fusca* (MCZ 1872, cotype; × ¾): I, dorsum; J, profile; K, venter.



Zachaenus parvulus (USNM 96313, × 1): A, dorsum; B, profile. *Elachistocleis ovalis* (USNM 121333, × 1): C, dorsum; D, profile. *Hypopachus mulleri* (USNM 97990, × $\frac{3}{4}$): E, dorsum; F, side view; G, venter. *Microhyla subnigra* (USNM 97718, × $1\frac{1}{2}$): H, dorsum; I, profile. *M. subnigra* (Lutz Coll., × $2\frac{3}{5}$): J, dorsum; K, side view; L, venter.



Stereocyclops incrassatus (photographed by A. de Carvalho, × ½): A, living frogs from Caxias, Rio de Janeiro. *Trachycephalus nigromaculatus* (MHNP 4609, type; × ½): B, dorsum. *Hyla langsdorffii* (MHNP 4634, type; × ½): C, dorsum. *Cycloramphus fulginosus* (MHNP 750, × ½): D, dorsum. *Hyla goughi* (BM 1911.9.8.5, type; × ¾): E, dorsum. *Bufo d'orbignyi* (MHNP 4960, type; × ½): F, dorsum.

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